RAILROAD GAZETTE

FRIDAY, JAN. 27, 1893.

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Contributions.

The 155th Street Viaduct.

NEW YORK, Jan. 23, 1893.

TO THE EDITOR OF THE RAILROAD GAZETTE:

In the article on "The 155th Street Viaduct and the Seventh Avenue Drawbridge," refined Trinidad should be substituted for Seyssel in composition of roadway mastic. Val de Travers rock asphalt was used instead of Trinidad for finishing the surface of sidewalk.

W. G. TRIEST.

Some Details of English Block Practice.

TO THE EDITOR OF THE RAILROAD GAZETTE:

I am continually surprised by the lack of information which causes many people to refer to the P. R. R. mode of operating the block system as the "English block system." In the first place, there is only one true block system, viz., the space interval, as compared with the time interval. The various methods of carrying out the block are too often considered as separate systems. It is a notorious fact that some of our roads rely upon ordinary telegraph speaking instruments for block signal communication. This practice was condemned more than 20 years ago in England, from practical experience gained by officers who had to deal, even at that early day, with such congestion of traffic as some of our lines have only just commenced to feel.

The fact is that the English roads have successfully used for many years special block instruments, which give both audible signal by bell and visual signal by miniature semaphore, disc or needle. The safeguards and checks, in connection with these instruments, both by means of mechanism and mode of working, are too numerous to mention here. The well-known Sykes lock and block apparatus is an off-shoot of these appliances. For some time it has seemed to me that the instruments I refer to are exactly suited to those American roads which cannot afford the complete concentration and interlocking of switches and signals so advisable with the lock-and-block apparatus, and it is strange that not only are our lines devoid of such aids, but their advantages are generally unknown. In such cases I would recommend the visual and audible instruments of Preece or Tyer or some other good maker, with Sykes for tunnels and congested traffic.

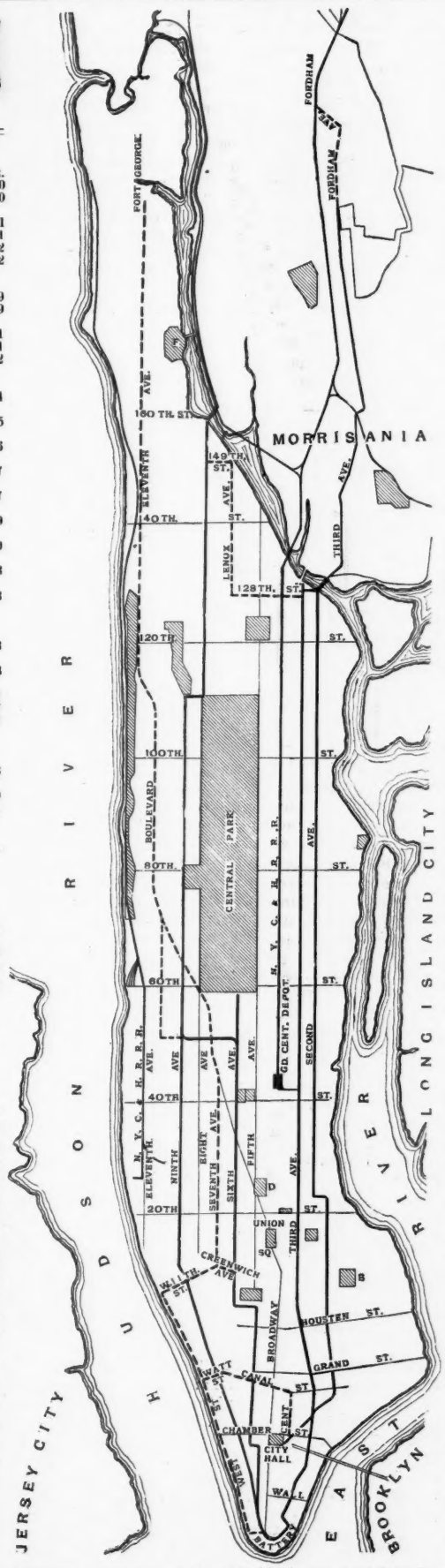
There are undoubtedly many lengths of railroad for which the expense of manual blocking will not be entertained, and purely automatic signals will be used. Experience has, I believe, proved that all such automatic signals should have all their moving parts inclosed in a case to be safe.

ARTHUR H. JOHNSON.

Rapid Transit in New York.

The Manhattan Railway Company has made application to the Board of Rapid Transit Commissioners of New York for certain additional privileges in that city. It asks for the determination of routes by which its present lines may be extended so as to connect with other railroads, with ferries and with its own existing lines; and it asks also for the privilege of adding third and fourth tracks on certain existing structures. The application also mentions increased terminal facilities, although we see no specification of what terminal facilities are asked for. An outline map is given herewith, showing in a general way the existing lines of the company and the extensions which it wishes to make. Although the map is somewhat defective in details, it is sufficiently complete to give a comprehensive idea of the extensions proposed. In brief, the extensions asked for are as follows:

On the west side, to begin at the intersection of Greenwich avenue, Sixth avenue and Eighth street, at a point on the existing Sixth avenue line, thence to go northwestwardly through Greenwich avenue to West Eleventh street, thence southwestwardly to West street, thence down West street along the water front to Battery Place, and through Battery Place to the station at the intersection of Battery Place and Greenwich street, where the existing Ninth avenue and Sixth avenue lines join. This is to be a two-track route.



Proposed Extensions of the Manhattan Elevated Railway Company's System.

NOTE.—The Forty-second street extension is omitted by mistake. Heavy full lines show existing structures. Broken lines show proposed extensions. Application for additional tracks on existing lines not shown.

Starting from the same point from which the above extension starts, a new line is to go up Seventh avenue to Forty-fourth street, thence along Broadway to the Boulevard and to Eleventh avenue and to Ft. George. This line is to have three tracks from the intersection of Greenwich avenue, Eleventh street and Seventh avenue throughout its whole length.

Another extension begins at West Broadway, South Fifth avenue and Canal street, and passes through Canal street to Centre, thence down Centre street to Tryon Row, to join there with the City Hall branch of the Third avenue line. This is to have two tracks. The westward extension from the same point passes through Canal street to Watt and thence to West street. This also is a two-track line.

Another extension begins at Sixth avenue and Forty-second street, and goes through Forty-second street to join the Grand Central Depot spur of the Third avenue line at Fourth Avenue. This is a two-track structure.

Another line begins at the intersection of Fifty-third street and Ninth avenue, being a prolongation of the Fifty-third street cross-line, and this extends through Fifty-third street to Tenth avenue, thence up Tenth avenue, to the Boulevard line. This is a three-track line.

Another extension is to leave the existing Eighth avenue line at 149th street and pass thence eastwardly through 149th street down Lenox avenue to 128th street, then east again through 128th street to Third avenue. This is a two-track line.

Another extension is to begin at Third avenue and Tremont avenue or 177th street, on the existing line of what was the Suburban Rapid Transit road, and follow Third avenue, Fordham avenue, Kingsbridge road and and College avenue to the Fordham station of the Harlem railroad.

Permission is asked to lay one additional track on the existing structures as follows: Beginning at or near the junction of the Bowery and Third avenue, thence north along Third avenue to 129th street; beginning at the intersection of Fourteenth street and Ninth avenue, along Ninth avenue to 110th street, through 110th street to Eighth avenue, then along Eighth avenue to the Harlem River and 150th street; beginning at Chatham square and going northwardly along Allen street, First avenue, Twenty-third street and Second avenue to 129th street. Permission to lay two additional tracks is asked for the existing route beginning at Chatham square and running along the Bowery to Third avenue.

These appear to be all of the additional rights that the Manhattan asks for, and it will be noticed that there is no request for permission to add to its facilities at the south end of the island, or to provide switching and other terminal facilities elsewhere.

A Few Collisions.

At 5:30 o'clock on the evening of Jan. 19 a local passenger train of the Pennsylvania Railroad, west bound, which had been stopped at the coaling station west of Marion, N. J., for slight repairs to the engine, was run into at the rear by a following express train, wrecking the ends of two or three cars and pushing the whole train forward some distance. One passenger was killed and 12 others injured. The engineman of the foremost train, who was under his engine, was badly injured. One account states that he was thrown out against the engine of an east-bound passenger train which came along at that moment on the adjoining track. This east-bound train struck portions of the wreck, but was not much damaged itself. It appears that some of the passengers of the standing train had got out and barely escaped being run over by the east-bound train. The collision occurred about 80 rods west of tower H B, and the operator at that tower admits that he showed a white light, signifying that the block section was clear; but it is understood that he claims that the operator at the outgoing end had notified him that the section was clear.

At 4 a. m., on Jan. 21, an east-bound express train of the Pennsylvania road was stopped near Docklaw block station, east of Harrisburg, for repairs on the air brake, and while standing there was run into at the rear by the second section of the same train, wrecking the rear car of the foremost train, which was a sleeping car from Williamsport. This car took fire from the engine and was partly burned up. There were four passengers in it, two of whom were seriously injured. It is said that the block signal operator at Steelton admits having admitted the second train to the section before he had received proper authority from the next signal station. Five other passengers and the sleeping car conductor were injured. The engine in this collision, No. 132, is the same that was in the Harrisburg collision of June 25.

A collision on the Cleveland, Cincinnati, Chicago & St. Louis at Wann, Ill., about 9 o'clock on the morning of Jan. 21 resulted in the death of more than 20 people and the injury of many others, most or all of the victims being burned by oil which was spread by the explosion of some tank cars that were broken by the collision. It does not appear that any of the victims were passengers. The train, which was the Southwestern limited, east bound, ran over a misplaced switch and into a string of cars standing on a sidetrack. The train was running at high speed, and the engine crashed entirely through one of the tank cars and was then forced on and entirely over

the next one. The oil from the wrecked tanks at once caught fire and flames instantly surrounded the engineer, who had jumped just as the pilot of the engine struck the first tank. He was burned to death. The baggage car was burned up, but all on the train escaped except the engineer. The flames spread to the other oil cars, and a large crowd of people gathered to view the spectacle. About 11¼ o'clock five tanks, containing about 7,000 gallons each, exploded almost at the same instant, and the burning oil was thrown 200 ft. or more in the air, and came down on the standing crowd. Some persons standing close to the cars were less injured than those standing 300 ft. away. The scenes of the ensuing panic were heartrending in the extreme, and the sufferings of the victims were terrible. The number killed on the spot was seven, in addition to the engineer. About 25 others re named in the list of severely injured, of whom more than half were expected to die. The flames enveloped and completely destroyed two houses which stood near the tracks. Other houses were also ignited, but the fires were extinguished before they were consumed. The final explosion seemed to dissipate the fire, the fuel being so widely scattered that it soon subsided, and went out altogether.

At Lonsdale, R. I, about midnight on the morning of Jan. 18, eight persons were killed, and a number of others injured at a highway crossing of the Worcester division of the New York, New Haven & Hartford, a sleighing party returning from Attleboro being struck by a regular freight train, running about 20 miles an hour. The crossing is guarded by a flagman in the day time, and until 9 p. m. The driver of the sleigh is among the killed.

A Lesson in Trestle Construction.

Some months ago the author of this article was dispatched by a certain railroad company to examine into the cause of the failure of a large trestle upon its line, and the facts and condition of affairs that he discovered were so remarkable that he now begs leave to present them to the railroad public through the medium of the *Railroad Gazette*, with the hope that the lesson that is taught by them will be taken to heart.

This accident seems to have escaped the attention of not only the railroad and engineering papers, but also of the daily press, and yet the author believes it to be the *biggest fall on record.*

The trestle that collapsed was 812 ft. long and had a height in the centre of 131 ft. The track was on a gradient of 0.8, while the alignment was straight, except the commencement of a 4 deg. curve at the lower end, covering four bents. At the time of the accident a train was in the act of crossing, and had nearly reached the upper end when the structure collapsed, it all falling except three bents at the lower end of the curved portion.

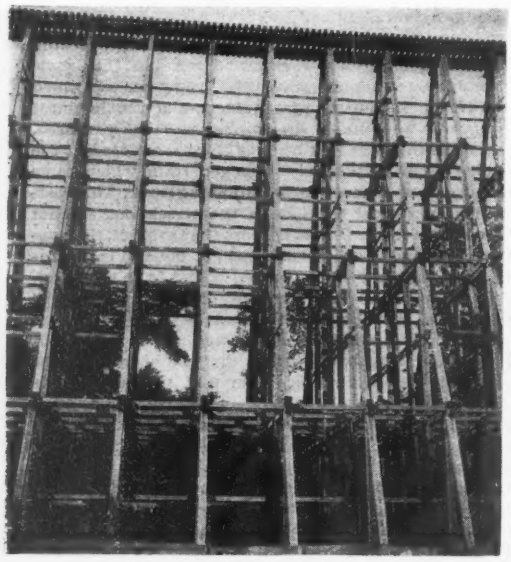


Fig. 2.—A 116-ft. Trestle Without Diagonal Bracing.

The trestle was built of hewn oak, the plans of the bents and the general arrangement of timbers being as shown in fig. 1, from which it will be seen that as far as strength of material went the trestle was more than amply strong to carry any possible load that could be brought upon it. It therefore did not collapse from any deficiency of strength, and, as the structure was only three years old, the timber had not decayed enough to weaken it, and a careful examination of the broken sticks showed that the timber had not rotted. A glance at the side and cross elevations, as they appear in fig. 1, shows the structure to be, with the exception of the battir posts, wholly without any diagonal bracing; and, inasmuch as the longitudinal purlins upon which each separate story rested were not run back to connect with the bank, they had practically no longitudinal strength at all.

Fig. 2, which is from a photograph of a similarly constructed trestle (116 ft. high), shows this lack of diagonal bracing in a more startling manner than the diagram of fig. 1 can.

These huge bents were founded simply upon mud sills, there being neither piles nor masonry beneath them to give them a sure footing, and, as the alignment ran diagonally across the valley, the bents on the hillside had one side resting in an excavation, while the other end stood upon a cribwork of wood. There was not a single bolt in the structure, and, in order to level up the separate stories as they stood upon the purlins, shims had been driven in, which were not even spiked to each other. This immense structure, therefore, was wholly without longitudinal stiffness, and was dependent for its stability simply upon the weight of the timbers to keep the bents vertical. In such a condition of unstable equilibrium a comparatively moderate shock would bring the whole structure down like a house of cards. It is uncertain what was the final straw. The train was being drawn by two engines separated by two empty box cars. From such evidence as can be secured it seems likely that the engineman of the second engine suddenly pulled his throttle wide open and buckled the two cars ahead. The shock of so doing dragged the upper row of bents out of plumb and then the whole fell. As the engineman and firemen on the second engine were killed reliable testimony on this point cannot be secured. The result of the collapse is very clearly shown in figs. 3 and 4, which are views taken opposite each other.

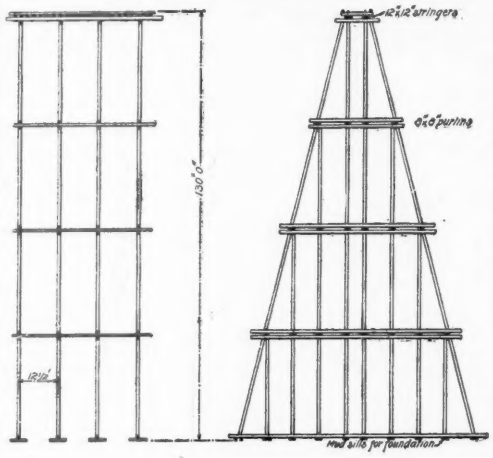


Fig. 1.

To show how it is possible for bents to work out of plumb, fig. 5 is a photograph of a trestle about 50 ft. in height, consisting of two stories, which, like the large example, was without longitudinal bracing, where it will be seen that the upper story is more than the width of itself, or 12 in., out of plumb, and the only thing that keeps this trestle standing is the weight of the track and floor, and the fact that the floor system is rigidly connected with the uprights. But it will be readily recognized that any shock, probably the sudden application of air brakes, would have been sufficient to bring this structure down. This trestle was located on a one per cent. gradient, and the angle plates had been spiked to the ties through slots, so that the track was rigidly connected to the floor, and the ordinary creeping of the track down hill had dragged the upper posts out of line. This picture also shows the pernicious system of shiming beneath the bents on the top of the longitudinal purlins.

Probably a more absolute disregard of the value of bracing, and a more complete and prompt showing up of such disregard, has never been shown, and it is hoped that the lesson the pictures teach will be grasped by all those whose duty it is either to erect such structures or to have the care of them afterward. In such a structure it is impossible to calculate the necessity for bracing, but that there is such a necessity this article with its pictures proves beyond a doubt.

Lubrication.*

Mr. Waitt: In looking over the paper I was very much surprised by the comparison of the cost of oiling freight cars which he states was in 1885, 27.67 cents per thousand miles, and then further along in 1891 the total saving, as compared with 1885, was over $38,000. That is more than it cost the Lake Shore road in a year to oil all its freight cars, although our mileage is nearly equal to the mileage that Mr. Barr shows for his freight cars. During the year 1891 the average cost of lubricating our freight cars was 9 cents per thousand miles with a fair service, although the oil was not up in quality to what we are using now, and the results were not as satisfactory.

A little over two years ago I had my attention drawn to the possibility of making quite an improvement in running our freight and passenger trains in reducing hot boxes and in saving the oil. I had a report made to my office of all the cases of hot boxes, requiring repacking of a box, replacing of a brass, or which detained trains, either passenger or freight, giving the car number, the date of the train, and also the cause as near as could be ascertained or given by the inspector.

I was at once impressed with the large number of cases of hot boxes due to lack of oil and waste and to worn-out brasses, a larger proportion of hot boxes occurring from those causes than from any other of the 12 different reasons which I gave in the schedule to report on. I found that the waste taken out of some of the boxes was almost as fine as if it had been in a chopping machine and chopped up for feed for horses. It would be filled with dust, fine particles of brass and cinders, and was in no condition at all to hold the oil. Then I looked up the practice in the shops and at the various inspection points with regard to renewal of waste packing in the boxes, and I found what I found quite prevalent on other railroads. I found that when a car came into the shop, one man would go along, lift up the oil box cover and look in, take his packing iron and pack the waste down, put in a little fresh waste—it might be dry and might not—put in a little oil and think he had done a good job. Some of these cars would go out of the shop and before running a hundred miles the boxes would have to be repacked, and the report came in that the cause was dry packing or lack of sufficient packing.

The result was, directions were given to all our shops that in every one of our own cars that came into the shop the packing was to be entirely removed from the boxes. It was not to be put back in that car under any circumstances, but was to be sorted, and if it was very dirty, thrown away, and if part of it good and part bad, the bad should be thrown away and the good put into a barrel, covered with oil and allowed to soak for at least 48 hours before being used again. Then the boxes of that car were to be repacked with the freshly soaked waste. The result in the course of six or eight months began to be seen in the decreasing of hot boxes on the Lake Shore cars from the cause of dried waste and packing, or lack of waste. Of course with regard to foreign cars we give them enough packing to carry them over our line.

Then I found that the oil and waste were not the only cause of hot boxes, but also the journal bearings themselves came in as a very important factor, and for a while I had the journal bearings that were removed from cars on account of hot boxes sent to one of our shops and cleaned and broken, so that I might see the fracture of the bearings. I am doing the same thing now with regard to passenger bearings in every case of hot boxes. One of the causes mentioned quite prominently in connection with hot boxes was hard spots in the centre or bright spots. I thought at first that those were caused almost entirely because the inspectors had not given proper attention to stirring up the waste and seeing that the box was fully packed, but I was soon led to change my mind with regard to that. Although some of the cases might have come from that cause, yet I was assured from the fracture that many of the cases of hard centres, as they were called, came from spots of poor metal, sometimes absolutely black, other times running from black up to a copper color, and in almost every case of hard spot in the centre, I found this feature in the surface of the metal, so that it impressed me that it had a good deal to do with hot boxes. I knew we were making some of the journal bearings in our own shops that were absolutely of pure metal, new metal entirely, yet I found the same defect by breaking new brasses, and after considerable investigation I was satisfied with the processes that we used in our own shops that we could not be sure of having a good homogeneous fracture, and the metal had to be worked in a different way. The results cannot be obtained by taking so much copper and so much tin and melting them together; but I found that metal had to be worked again a second time and remelted before you could be sure of getting homogeneous metal.

The matter of waste I think plays a less important part. Some of us use cotton waste; some wool waste; some wool waste or cotton waste with a great deal of dirt in it; and some waste that is clean and a good quality. From the experience I have had, it has not played so important a part in causing or preventing hot boxes, although with using a good wool waste—not the best—we have found on passenger service that very manifestly improved result has been obtained. The packing seems to be more elastic with the wool than with the cotton waste, and seems to keep up around the journal much better, and to take oil and feed it from the bottom of the box to the journal much more readily. The cotton waste seems to pack down in the bottom of the box into a hard mass, and also where the cotton waste had been used in the back of box, it would seem to be packed in so that it would almost require a hammer and chisel to get it out. There has been a benefit from the wool waste and with no material increase in the cost, because a pound of wool waste would go further than a pound of cotton waste, even if it cost more.

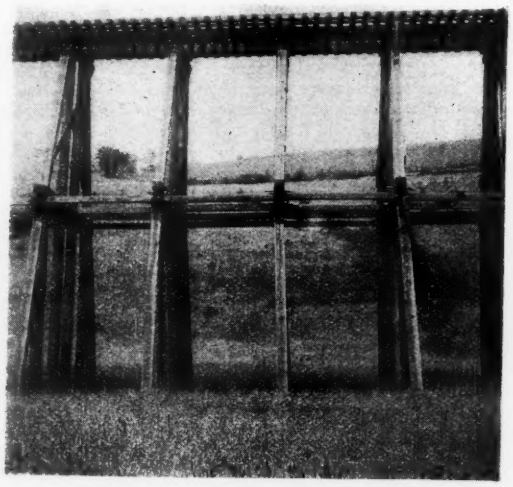


Fig. 5.—A 50-ft. Trestle Which Happened to Stand Up.

In 1890 we used for freight cars, 212,965 gallons of oil, with a mileage of 297,699,696 miles; the average cost per thousand miles for that year was 8 cents; for passenger cars we used 28,041 gallons of oil with a mileage of 23,202,885, at a cost of 18 cents per 1,000 miles. We did not commence to take the record of the hot boxes until September of that year. During the last four months of the year there was an average of 1,122 hot boxes on freight and an average of 54 on passenger. That divided into hot boxes per thousand miles would be .046 for freight, and for passenger .028. In 1891 we used 265,007 gallons for freight, with a mileage of

* Discussion at the December meeting of the Western Railway Club, of Mr. Barr's paper read at the November meeting. (See *Railroad Gazette*, Dec. 2, 1892.)

Fig. 3.—Wreck of a 131-ft. Trestle.

293,827,664, and for passenger we used 35,772 gallons of oil with a mileage of 24,493,149. The average per month of hot boxes that year was 975, against 1,122 for the average of the last four months of the previous year, and for the passenger cars 55—no improvement on that. The average per thousand miles was .039 and .027, an improvement on the freight of .039 against .046. No improvement on the passenger. During the year 1892 of course the records are not complete, but I have made a comparison of the first ten months of the year 1891 and the year 1892, taking the number of gallons of oil for freight service for a thousand miles and find that we used per thousand miles .912 gallons of oil per thousand miles in 1891. In 1892 with the better grade and more care in its use only .639—that oil is the same, I believe, that Mr. Barr is using—making between the two years a saving in quantity of 30 per cent. on freight service. On passenger we also made the change of oil, but do not have the same improvement in results. In the passenger we used 1,368 gallons per thousand miles in 1891, and during the corresponding months in 1892 1,445 gallons per thousand miles.

Mr. Schroyer: I would like to ask Mr. Waitt, as well as Mr. Barr, whether they have any figures on the cost of labor. I consider that in the cost of the oil used to lubricate per thousand miles, you have only told half the story. The other half is the amount of labor involved. An oil man once said to me that it required half as much time to pour out a thousand gallons of oil as it does two thousand gallons of oil. I do not think that is right at all. As for the inspector doing that work, our inspectors do not do it. We have oilers who do this work. For a number of years we used an oil box lid that required a special tool for looking into the box, and as a consequence our inspectors and oilers got negligent. They did not look in. They would feel it. I realized that difficulty after going over the road and trying to find out the cause of our hot boxes. I at once gave orders that every box must be opened, but that didn't open the boxes, and I found the only way to do was to put on a lid that could be opened as quickly as you could put your hand on to find out if they were hot. I have seen oilers feeling the box with gloves on to see if it wanted oil. When I say only half the story is told, I believe it to be so, because in properly lubricating the car you have to look into the box to find out whether it needs oil or not. I also issued instructions that the oil must be saturated a certain length of time. This improved matters very materially in the cost of lubrication, but what we were gaining in the cost of oil we were losing in the cost of labor involved. We not only carry saturated waste, but we carry a pail of oil, so that where a box has got sufficient waste but is running dry we can give it oil, and where boxes want waste we give saturated waste and oil, if it needs be. As a result we have materially increased the cost of labor.

Mr. Waitt: At one point on our road during the last two years we have added one day man and one night man as oilers. There has been no addition or reduction aside from that that I know of in connection with the oiling of the cars. This was done at a large interchange point, where I found that there had been very little attention paid to the examination of the boxes in the cars, and I thought it was necessary.

Mr. Rhodes: There is one point that Mr. Waitt calls attention to, namely, the fact that his road is lubricated so much cheaper than the Milwaukee road. In Mr. Barr's report he says that some railroads give too much attention to investigation and testing material and do not give enough to supervision. I should infer that Mr. Waitt is giving good supervision on his road. The Lake Shore does not have any laboratory, I understand, therefore, it is fair to assume that they are not spending time testing material, but are giving the time to supervision. On our road we give a good deal of care to testing material, as they also do on the Milwaukee road, and if railroads give good supervision and good care to testing material, we ought to expect the best results.

There are a few upon which we have some interrogatories and comments to make. In the first place, the basis of the comparison is on a cost per thousand miles run. It is not clear in this comparison, whether an empty car is placed on the same footing as a loaded car. That is to say, whether an empty car 1,000 miles is figured as consuming the same oil as a loaded car 1,000 miles.

On the Chicago, Burlington & Quincy car miles are worked up on a loaded car basis. The empty car mileage is reduced by one-third and thus converted into loaded car miles, so that any figures I give shall apply to loaded car miles. Then, again, in the report, while undoubtedly it is covered in some way, it is not clearly explained how the tallow or grease that is used in caring for hot boxes is accounted for, whether that cost goes per thousand miles or not. On our line all grease or tallow that may be used is put into the cost per thousand miles. The point, however, that I think is open to most criticism is the fact of the figures being shown as to cost per thousand miles. I think that whenever we begin to compare operations of different roads on cost per thousand miles and to draw deductions from that, that we get ourselves into trouble. To illustrate what I mean, I have blocked out here a statement showing the cost per 1,000 miles of lubricating locomotives on the Chicago, Burlington & Quincy road for two or three years past. Average cost per 1,000 miles run of lubricating locomotives on Chicago, Burlington & Quincy Railroad, exclusive of cylinder oil and illuminating oil:

Year 1890.	Year 1891.	Jan. 1892.	June, 1892.
92.93	29.72	30.38	23.01

In 1890 it cost us 92.23. In 1891—shall I say by diligent care and supervisiion, careful work, etc.?—the cost was 29.72. Reduced, you see, enoomously. In January, 1892—I do not want to say by neglect—it jumped to 30.38, but if you are going to draw inferences from cost per 1,000 miles I see no hope for any other conclusion. In June we got down to work again, and the cost per thousand miles was 23.01. There is a wonderful improvement, you will see, if you take June, 1892, with the average of 1890. But I think a better way to get at the value of these figures is to take the miles run to a pint of oil.

Average number of miles run per pint of lubricating oil by Chicago, Burlington & Quincy locomotives:

Year 1890.	Year 1891.	Jan. 1892.	June, 1892.
24.40	23.14	25.20	22.82

In 1880 we were making 24.40 miles with our locomotives to the pint of oil. In 1890 we made 23.14. You see, not quite as good. And in January, 1890, we did a little better, we got 25.20, and in June, 1892, we only made 22.92, so that notwithstanding the fact that there were these great reductions in the cost per thousand miles, we were really consuming more oil. The chief reason for this, of course, is the cost of the oil. In 1890 we paid 18 cents a gallon for our oil. In 1891 we paid 5½, January, 1892, 6½; June, 1892, 4 2-5. I do not know how these locomotive figures compare with our neighbors, but in any event I do not think it proper to compare them. Our engines are mostly Moguls and consolidation engines, which have many bearings, and consequently it takes a good deal of oil to run them. In these figures that I have given it should be noted that cylinder oils and illuminating oils are not included. Now in the matter of lubricating freight cars, on the loaded car basis, if we consider oil only, the cost per thousand miles is 9.77 on the Chicago, Burlington & Quincy. If we figure in all lubricants, that is, the grease that we use as well, it comes to 11.32. I do not know whether Mr. Barr's figures are made on loaded basis or whether they include grease. In view of our cost being on a mileage reduced to a loaded car basis they compare favorably with any figure presented. We are using Galena oil.

Mr. Barr: We figure our mileage on the total car mileage, irrespective of their being loaded or empty. With reference to tallow, the question as to whether tallow and lubricants of other kinds are figured in the cost of lubrication, I would say that in statement No. 1, of my report, we give the actual quantity of oil used, but in giving the total cost, the cost of tallow and grease of every kind is figured in for each division, so that the cost is the total cost of all material used in lubrication. Another question that Mr. Rhodes brought up is that figures may be very deceptive on account of the different price of the material used. I think that I clearly say in my report that the same ma-

Fig. 4.—Wreck of a 131-ft. Trestle.

terial was used during the periods covered by the report.

Mr. Rhodes: The same price, I suppose?

Mr. Barr: The same price, so far as I know; I do not quite agree with Mr. Rhodes that the coal is not the proper thing to use, but actual mileage, because it is the cost that we are after, and if by using 18 cent oil it costs more than to use 4½ cent oil we had better use the 4½ cent oil, unless there are some objections to it, and it seems to me that the final sifting out of all railroad business is undoubtedly the cost, whether we use 50 cent oil or 5 cent oil, the end of it is, what is the cost of the service and that is the measure of efficiency. I do not think any one of us should attribute any great merit to ourselves if we use 50 cent oil and get twice as much mileage out of it as if we used a 10 cent oil, but if we use a 50 cent oil and get six times as much out of it as a 10 cent oil, then we are doing well.

At the same time the actual cost is not the only thing to be taken into consideration in this matter of lubricating freight cars, because we have hot boxes and detentions to trains. And I would say another thing here, and that is that it is a thankless task for two railroads to compare results. That is, one road may oil its cars at 10 cents a thousand miles and another at 15 cents a thousand miles. Now that is too far apart if they are using the same material, or if the service is of the same character, but at the same time it is almost impossible to say that the one who is running at a cost of 10 cents a thousand miles is doing proportionately more—50 per cent more—in obtaining good results than the one who is running at 15 cents. The character of the service, the weight of the cars, and such variables come into consideration, so that it is impossible to make any close comparisons or to say that I am better than you or you are better than I. That is a point that I do not think ought to come into consideration in our discussions here.

But there is a question that comes up, and that is this: If we can reduce the number of hot boxes from 10,000 or 12,000 a year to 5,000 or 6,000 a year, how much more can we afford to pay for the lubricating of the cars to do that? When you figure in the train detentions and so on, it is something that really cannot be estimated, but at the same time it is an important question. Many a time a train detention has caused a wreck, and anything that will reduce the tendency to disturbance of the movement of the trains on a railroad we can afford to pay a fair figure for and expect to get it back.

I did not present these figures with an idea of showing a minimum cost—I have been getting figures from other roads and know that we are not as low—but I did present them with the idea of showing several things. One is that by watching the matter we made a very great improvement with the same material. Another is that, as shown in the statement, there was an increase of 300 in the number of hot boxes in 1891, as compared with 1889 and 1890. Now we passed through an experience very much like what Mr. Waitt detailed, and I think it is covered in the report, which gives a circular letter showing that very state of affairs. I think myself that the showing in 1891 of 11,630 boxes for the year was occasioned by other circumstances in addition to lack of proper attention and supervision, and that is, there was a great deal of construction work, the season was very dry and the boxes were in very bad condition from those causes; but what I mean to show is, that with proper supervision that increase of hot boxes ought to have been avoided, and I think that those hot boxes cost the railroad company $10,000. The increase in that number of hot boxes, when you figure in damaged journals, destroyed brasses, new waste, loss of oil and detention to trains, $10,000 would not begin to cover it, and I feel that that $10,000 was lost by lack of supervision. Now, in reference to inspection and testing of material, I do not think I said in my paper anything derogatory to the practice, and I do not want to be put in the list of those who consider that it is not a good thing to test and inspect material. What I did say, however, I think was this: that we, as superintendents of motive power, were devoting a great deal of attention to testing new machinery and getting up specifications and testing material, and then turn our improvements out to perhaps ignorant and unsupervised men to use just as they see fit, and I do think to-day there is not enough attention devoted to that matter, and that it is extremely important.

Mr. Townsend: It is not only a point to save all the oil that we can, but sometimes I believe that we have been trying to save too much and thereby we create hot boxes and that means destroyed brasse and cut journals, and I think that brasses and cut journals should be figured in with the oil. Now the number of hot boxes that Mr. Waitt spoke of is simply enormous, and it cost something to clean up those journals and to supply new brasses. I don't believe that the Alton road is oiling its boxes as cheap as that, but I do think that we don't have very many hot boxes. We soak all waste for a week before we use it; we won't allow it to be used in any other way.

Mr. Barr: I am inclined to think that in nine out of ten of the cases reported as dry waste, the dryness of the waste results from the heating of the boxes rather than from the boxes being actually dry, and that being the cause of the starting of the heating. Mr. Waitt says that he has found wool waste superior to cotton. Now, I might have added in my report that there were two changes made, one was we dropped the use of wool waste about the beginning of this report and gradually worked into the use of cotton waste. The other was that about five years ago we dropped the use of solid brasses and commenced the use of brasses filled with a metal filling consisting of 85 parts lead and 15 parts antimony, using a brass shell to hold it in position. How much these changes may have influenced the results I do not know, but the results of my observations have induced me to differ diametrically from Mr. Waitt in thinking wool waste better than cotton. There are a number of arguments in favor of this. We never use woolen wicks in conveying oil to the flame of a lamp. I don't know whether it was because woolen did not convey the oil as well as cotton or not, but I made a number of experiments by taking fibers of cotton and woolen waste nad putting them in a glass with oil in the bottom of it, and I found that the cotton waste certainly carried the oil up much better than the wool, carried it up much quicker and in larger quantities, and if the fibers were allowed to hang over the vessel you would find a considerably larger quantity of oil carried over from the vessel with the cotton waste than the vessel with the woolen waste. If you take a certain volume of woolen waste and cotton waste, you will find the cotton waste will hold in suspension a much larger quantity of oil than the wool waste. Another point, we lost a very large quantity of the oil by its running out at the back end of the box, and I venture to say that a box well packed with cotton waste will prevent that running out at the back much better than one packed with wool waste. In fact, I believe that there is a large saving of oil occasioned in this way; the open character of the woolen waste allows oil to flow freely through it and out the back of the box, if there is too much put in. Now, taking all of those things into consideration, and taking the actual results obtained from the use, I feel that I have pretty strong reasons for considering cotton waste better than woolen waste for lubricating car journals.

Mr. Waitt: In my previous remarks I stated that I thought that the kind of waste used bore but a minor relation to the increase or decrease of hot boxes. I think so now, and it is a little amusing to see that our improved results in lubricating have occurred with diametrically opposite changes. We went from cotton waste to wool waste, and from shell brasses to solid, so I think that both of those things have but little part to play one way or the other. We got improvements changing from cotton to wool, and they got improvements changing from wool to cotton. I would say, to correct a possible misapprehension of what I said before, we made the change to wool waste only in the passenger equipment, and as a matter of experiment and trial, and then after the boxes have been packed six months in the passenger cars we removed the packing and used it in the freight. But with the shell brasses I found a great deal of trouble. Just as soon as they got hot the inside would run out and then we would have cut journal. We have a less number of cut journals than when we used the shells. With regard to the woolen lamp wicks, I have had some little experience with them. I think the principal objection to woolen lamp wick is that it crusts over too easily, but it is not on account of its feeding the oil so much better that the wool may be superior to the cotton. The important thing is to find something that has sufficient life and elasticity so that it will keep around the bearing and not sink.

Mr. Barr: I think Mr. Waitt's experience and mine in waste and brasses reinforces the position that I have taken in the paper, that there is not so much use in devoting so much attention to just the right kind of bearing and just the right kind of brass, as there is in getting good use out of what you have. I don't believe that anything could have come up that would have been a stronger indorsement of the position I have taken in the paper than the points just now brought out.

Mr. Waitt: I would like to say one thing additional with regard to supervision. I found a very singular thing in making inquiries among our inspectors two years ago, as to what their understanding was of their duties in looking after the oil boxes on the cars that passed through their stations. I found no two had the same idea. They had no definite idea of what they ought to do. At some stations, where there were plenty of inspectors, when cars came in, if a car that had come off the road had not been smoking they thought they had no duties in connection with it. At other points I found they would just lift up the box and automatically give the waste a little stir, put in a gill of oil and let it go, but there was no uniformity. So I found it necessary to have an understanding about it, and require the inspectors at all interchange points to see that all cars before they left them had oil enough in them and enough waste properly stirred up to carry them over the line of the road without any probable trouble, and if any hot boxes occurred on the car they might feel sure that it would be traced back to them, and if they had not done their duty, it would sooner or later be found out. I also found it necessary to instruct inspectors at any station to make some examination of all cars set off to be loaded or unloaded. Also the examination should include the condition of the brass, whether it appeared to be fitting properly, and whether the key was out of or in its proper place, and those two points I found helped very manifestly, provided they were followed up as we tried to do in getting better condition of boxes. The trainmen on the road and men at the stations spoke of the less trouble with hot boxes, and those that did occur not requiring renewal of the brasses, but simply a little more oil or waste. I might say, in addition, as to the matter of tallow spoken of, that we do not use or allow to be used on freight cars any special oil, tallow or lubricant other than the common oil that is provided.

Mr. Peck: The difference in figures, I think, is accounted for by one thing that is not mentioned in this report, that is the ballast. A poorly ballasted road will consume more oil than one well ballasted. Then a sand road is hard on oil. Probably Mr. Barr may run out west, where he runs on a good deal of mud road, as we term it, and that is bad on oil. As to the supervision, I fear we are increasing the duties of our men too much. We make our inspectors do clerical work, and all manner of things they have no time to do. Talk about the inspection of journals, I do not suppose there are many journals inspected if found cool. The inspectors have too much to do for the number employed.

Mr. Schroyer: We use a shell with Babbitt filling, I think about the same proportions as the Babbitt mentioned by Mr. Barr. We are entirely satisfied with the boxes we are using, but at the same time feel a good deal disattisfied with the brasses we find on foreign cars. We have three or four cases of hot boxes with the solid brass to one of the filled brass, which is evidence, to my mind, that there is either something wrong in the construction of the solid brass or else the filled brass has advantages not possessed by the solid. As regards our methods of determining the cost of our waste, tallow and oil, we have blanks especially for that purpose that are put into the hands of every foreman that has oiling to do at his station. He reports monthly the amount that he has used for all the different purposes. It is measured out and recorded either on a slate or on a board, or sometimes he notches down on a stick the number of times he gets oil from the warehouse. I think the reason why locomotives make a good showing in the cost of lubricating is because the lubricator can stands along the road waiting for a hot box to come into that neighborhood and the engineer or fireman sees it there occasionally. I sometimes think, too, when I see a railroad that is making an unusually good showing in regard to the cost of lubricating that some of we fellows are helping them. We are not doing it intentionally, if we are.

President Lewis: I think the point has been pretty well brought out that the question of supervision is more important than the quality of the material used and the very best and most intelligent efforts of the heads of departments are sometimes defeated by the carelessness of the men who are employed to do this work, and also that we do not always inform ourselves just what can be accomplished in the matter of lubrication; that if the statement appears to correspond or compare favorably with our neighbors, we are apt to be satisfied with it, when the fact is we could do a great deal better if we tried. A short time ago I had curiosity to know something about the limit of valve oil, and I reached a result which may be interesting as showing just what could be done with a pint of valve oil. I found that our average consumption was in the neighborhood of 65 miles to the pint, and I selected an engine in good condition, with a careful engineer, and said to him, "I want to demonstrate just how far it is possible to run on a pint of valve oil, and I am going to fill your lubricator and I am going to solder it up, and I am going to see how far you can run." The result was that he ran the engine 1,720 miles on a lubricator of oil holding a little over a quart or something over 800 miles to the pint. I examined the valves and cylinders at the conclusion of the trial and found them in perfect condition, not a scratch anywhere. I simply mention this to show the possibilities in the matter of lubrication, and I think that more economy can be effected in the matter of lubricating cars by following up our oilers than we can in any other way.

Mr. Barr (in reply to a question): A passenger car was selected for a test and run for, I think, about 9,000 miles, at a cost of under 5 cents a thousand miles for lubrication, and that was a car with 12 journals instead of eight, as under the ordinary freight cars. Now we get better results in tests than we do in practical service, but if we could split the difference between 5 cents and 14 cents it would be a saving for our road, but I am frank in saying that we have not been able to do it. Of course there are other points which come into play in the matter of the formation of a hot box, brakes out of square, wheels out of size and wheels running to one side. I believe to-day if we had perfect running trucks that it would cut the cost in two. But I do not suppose there is a railroad to-day without its journals running to one side or the other. Now, whether it would cost more to correct that than you would gain, I do not know, but I believe that if a steady, systematic investigation were made of that part of the service, the trucks, keeping them in perfect condition, the company would get back five dollars for every one that they would spend.

The Baltimore & Ohio's Historical Exhibit at the World's Fair.

The fact that the exhibit which this road is preparing for the Chicago Exposition will be not merely an advertisement of that road, but a valuable collection of relics, models and documents of great historical value to every one interested in railroads, and gathered from Europe as well as America, is pretty well known from announcements heretofore made. The amount of work done is prodigious already, and the whole project has been placed in very competent hands, the direction of it being intrusted to Major J. G. Pangborn, who with his assistant, W. G. O'Brien, made a tour of Europe last year to get material. The work thus far done relates chiefly to locomotives, and we condense from the New York *World* the following notes relative to this department:

Among the institutions visited were the South Kensington Museum, London; the Conservatoire des Arts et Métiers, Paris; the National Museum, Vienna, and the Edinburgh Museum. Exact reproductions [in wood] have been made of the historical engines found in these collections. Digeon, the Paris model maker, said the reproductions could not possibly be constructed so as to be put in motion unless the cylinders, pistons and other working parts were of metal; but these made at Baltimore are, nevertheless, readily run upon the temporary rails on the factory floor, and will be so shown at Chicago.

The exhibit begins with the first method of propulsion by steam on land, that of Sir Isaac Newton in 1680; thence the evolution is indicated through the Cugnot (1769), the Murdoch (1784), the Read (1792). The latter, by the way, was the first steam wagon in America, and its designer, Nathan Read, of Salem, Mass., was the inventor of the multitubular boiler. Following the Read comes the first Trevithick, the initial design (1800) of the father of the locomotive, Richard Trevithick, a Cornish colliery foreman. In 1803 he built the first locomotive that ran upon a rail. Attached to the full size reproduction of this locomotive will be the two original little flat cars it drew.

Others in the series are the Trevithick (1808), the Brunton (1811), the Blenkinsop (1812), the Hedley (1813), the Novelty (1829) and the Stourbridge Lion (1829), the last named the first locomotive to turn a wheel in America. It did little more than turn a wheel; and the Cooper, on the Baltimore & Ohio, the year following, was not only the first locomotive built on the American Continent, but the first to run more than a mile and the first to draw a car. The Stourbridge Lion was an English engine imported for a stone tramway in Pennsylvania, near the New York line. Although it weighed hardly five tons, it was too heavy for the track, and was steamed up only once after being hoisted to the roadbed.

Major Pangborn and his assistants encountered great difficulties not only in meagerness of facts, but in conflicting and incomplete drawings. An illustration, made probably largely from imagination originally, gets to be regarded as standard, when, in fact, it represents a construction which could never be made to work. There is nothing theatrical or spectacular in the exhibit as it is being constructed and completed. On the contrary, there is a fidelity to the original, a rigid scrutiny of data and a search after every scrap of fact destined to render the showing throughout of the highest historical value. Of the trial of locomotives which took part in the Baltimore & Ohio competition of 1831 no connected account has been published, and not an illustration or drawing of any of the five locomotives designed and built in response to the company's offer of $4,000 in prizes is known to be in existence. After much laborious research, material has been gathered to enable the building in perfect fac-simile of all five locomotives. No single event in the railroad history of America could have been of higher historical value to establish than this.

It has been generally supposed that the half dozen well-known English locomotives comprised the importations for American roads, but Major Pangborn finds that up to 1840 no less than 68 English locomotives were sent here. The Stourbridge Lion, built by Foster, was the first locomotive placed upon a track in this country, but not the first ordered for use here. The America, built by George Stephenson, was the first, and it and a second engine by him should have reached these shores ahead

of the Lion. The so-called model of the Stourbridge Lion in the National Museum at Washington is found to vary widely from the original in its parts. Yet the illustration made from this inaccurate model is generally accepted and published as the Stourbridge Lion.

No foreign engine was employed or even tried on the Baltimore & Ohio, the ruling disposition of its management being to encourage and develop American genius. To such end it offered in January, 1831, large money prizes for competing locomotives. . . . All the locomotives entering in the Liverpool and Manchester trial, as well as those taking part in the Baltimore & Ohio trial, will be shown in full-size reproductions and in motion.

The first link motion in the world was on an American locomotive; also the first compounded cylinder. The first truck was American; so were the first equalizing beams and levers. The first locomotive built on eight wheels was in this country, and likewise the first locomotive to ascend steep grades. These will be shown, besides the first locomotive in actual service in this country, the first built here for the first railroad in New York State, the first built by Baldwin, the first built in New Jersey, Rogers' Sandusky, the first built by Ross Winans, the first built by the Baltimore & Ohio, the father of the standard eight-wheel American locomotive, the first eight-wheel engine built by Ross Winans and the latter's original "camel" locomotive, the first of the type of big fireboxes—all in full-size reproductions and all in motion, so that they may be studied in every detail of construction. Two-thirds of these important historical examples have been completed.

In perfecting the drawings for building the Best Friend, the first locomotive built in this country for actual service upon a railroad, the most perplexing data were found. None of the published illustrations, not even the tracings purporting to have been made from the original drawings, agree with autographic letters left by the man who superintended the construction and afterward ran the engine. . . . There is a question if English history is not at fault as regards the first effort of Richard Trevithick, the father of the locomotive. The model in the South Kensington Museum in London, purporting to be that submitted with his patent of 1802, does not accord with the description set forth in the application of that year.

Four of the original grasshoppers are still at Mount Clare shops, Baltimore, and as none were built subsequent to 1836 not one of the quartet is less than 57 years old. All were in active service until two were recently withdrawn to make the comparatively few changes necessary to restore them to original form.

Christian Smith, engineer of a grasshopper in 1833, is still living, and he will be with his locomotive at the Exposition. Joseph York, the engineer of the La Fayette 1837, the first horizontal boiler and the first six-wheel locomotive on the Baltimore & Ohio, is also living, and will be with the full-size reproduction of his old engine in Chicago. The fourth of the old engines will remain at work in the yard till the middle of April, and then be taken to Chicago just as it is, and shown after 60 years' continuous actual service, a record without parallel in the world

It is probable that the only example of the early type of the once noted New Castle locomotive is the Dragon (1848), which has been preserved by the Baltimore & Ohio, and the same is quite likely true of the Mason of 1853, which, although condemned to the scrap heap several years ago, was saved from destruction by a thoughtful hand. No man did more for the efficiency and shapely form of the American passenger locomotive than William Mason. That one of his earliest engines still exists is a source of gratification. It and the Dragon are both being restored to their original form, as is also the old Perkins ten-wheeler of 1863 and the "600," which was the Baltimore & Ohio's model locomotive at the Centennial Exposition in 1876. The Perkins was the earliest type of the tremendously powerful freight locomotives built by the company especially for service upon heavy grades. The "600," also built by the Baltimore & Ohio, was the first Mogul passenger locomotive constructed.

Walter Aiken, President of the Mount Washington Railroad, will contribute to this exhibit the original "Peppersauce," built in 1865, the first locomotive to ascend Mount Washington and the first mountain-climbing locomotive in the world. Throughout the exhibit the examples of motive power will be shown upon the rails and bed of their period, a remarkable amount of original material having been secured. There are on the way from Europe sections of rail, some antedating the present century, used on European tramroads as early as 1790.

In the collection are four of the original rails, with their chairs, upon which the Liverpool & Manchester locomotive trial of 1829 took place. The "Rocket" will stand upon these rails. It is the only existing full-size representation of the engine in its original form, the original "Rocket," so carefully preserved in the South Kensington Museum having been largely changed from what it was when the winner of the Liverpool & Manchester prize, ... Modern as well as ancient engines will be shown and also a great collection of drawings.

Theodore Cooper will prepare a series of pen-and-ink drawings showing the development of the American bridge, while Clement E. Stretton will complete drawings showing the development of the European railroad bridge. Mr. Stretton has been Major Pangborn's representative in Europe for months.

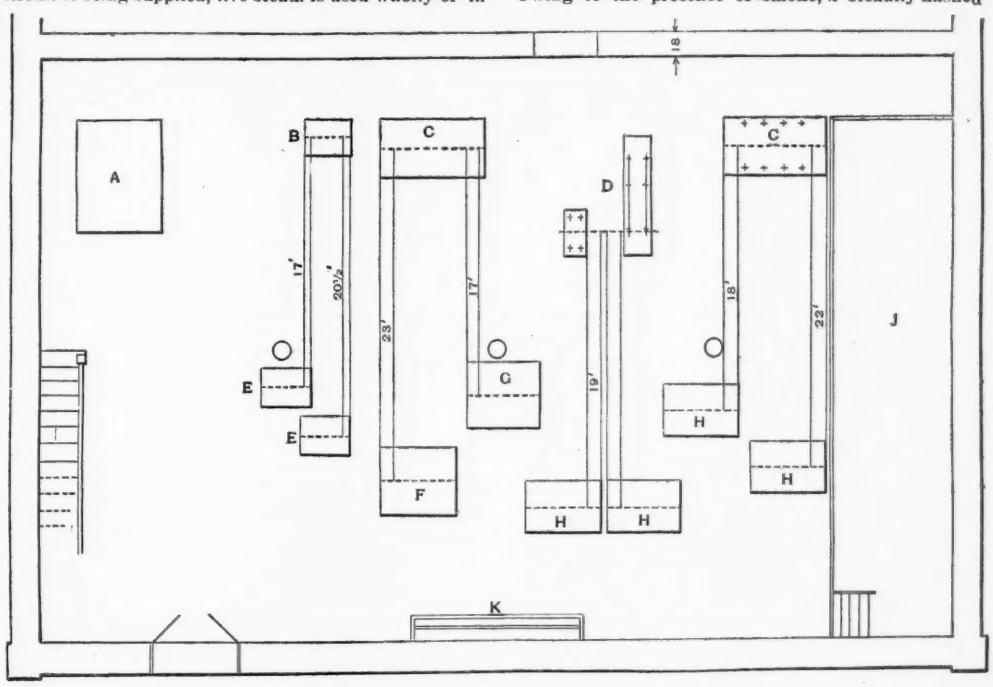
Major Pangborn is collecting a superb series of photographs showing a great variety of European locomotives, exterior and interior views of the royal trains of the world, and original drawings, lithographs, autograph letters and relics generally.

The Heilmann Electric Locomotive.

According to the *Revue Industrielle*, an electric locomotive of the Heilmann type is now in an advanced state of construction in the shops of the Forges et Chantiers de la Méditerranée, and is shortly to be put to test on one of the French state railroads. The chief peculiarity of Mr. Heilmann's locomotive, which was first brought to notice in 1891, is found in the fact that it will generate its own current, carrying for that purpose an electric generator and a steam engine to drive it. Both engine and generator are mounted on the forward part of the locomotive, the engine being of the horizontal, compound kind, while the generator is a continuous current, multi-polar dynamo. The boiler is located at the back with the fire-doors facing the front end of the locomotive. Each axle is driven by a separate electric motor.

The Chicago & Northwestern Heating and Lighting Station, Chicago.

The Chicago & Northwestern company has recently erected and is now using a heating and lighting station which is very well equipped in all respects. The station building is 60 × 65 ft. and is on Kinzie street, just north of the Chicago & Northwestern tracks and west of the new express building. The boiler room is 60 × 30 ft., and contains four horizontal tubular boilers each 18 ft. long by 60 in. in diameter and containing 48 4-in. tubes. The boilers are equipped with Hawley, down-draft furnaces and are connected to a hexagonal brick chimney 5 ft. inside diameter and 135 ft. high. The boilers are also fitted with Brinks' automatic boiler cleaner, which we are informed by Mr. William Smith, Superintendent Motive Power, is giving very good results. So far the boilers have been found to be perfectly free from mud and scale. The boiler feed pumps are two 7½ × 10-in., Worthington, duplex pumps. Steam is furnished by these boilers for heating all the terminal station buildings, including the baggage rooms, express building and the old general office building. The Williames vacuum system of heating is used. During the daytime, when the engines are not running or when only the circuit is being supplied, live steam is used wholly or in part for the steam heating. This steam is passed through a reducing valve and as much is used in addition to the exhaust from the engines as is necessary, depending upon the number of engines running. The distance from the boilers to the most distant point heated is over 1,500 ft. The steam pipe leading from the boilers is 12 in. in diameter, being gradually reduced as the distance increases and as the steam is taken off for the intermediate buildings.



Chicago & Northwestern Heating and Lighting Station, Chicago.

A, air compresser; *B*, 30-H. P. Westinghouse engine; *C C*, 80-H. P. Westinghouse engine; *D*, 75-H. P. Ide engine; *E E*, Edison dynamo No. 3; *F*, Thomson-Houston arc dynamo, 50 lights; *G*, Thomson-Houston arc dynamo, 30 lights; *H H H H*, Edison dynamo No. 10; *J*, pump pit; *K*, switchboard.

The general arrangement of the machinery in the engine and dynamo room, which is 60 × 35 ft., and occupies the eastern end of the building, is clearly shown in the engraving. The feed pumps, feed-water heater and the pumps and tank for the Williames heating system are placed in the pump pit on the north side of the building. In the southwest corner of the engine room is placed a 55-H. P. Ingersoll & Sergeant air compressor, a 4-H. P. Case engine, and a 50-volt Westinghouse dynamo which are used in the operation of the pneumatic interlocking plant, put in by the Union Switch and Signal Company.

The lighting plant consists of an 80-H. P. Westinghouse standard engine, which drives two 25-kilowatt Edison dynamos for incandescent lighting; one 80-H. P. Westinghouse standard engine, which drives one 50 light and one 30-light Thomson-Houston arc dynamos; a 65-H. P. Ide engine, which drives two 25-kilowatt Edison dynamos; and a 35-H. P. Westinghouse standard engine, which drives two 8½-kilowatt Edison dynamos. The capacity of the plant at present is about 2,500 16-candle power, incandescent lamps on the three-wire system and 80 2,000-candle power arc lamps. The building is two stories high and the engine room is high studded and very well lighted. The steam pipes are all carried overhead and are covered with non-conducting covering. The location of the switchboard, which is very well equipped, is clearly shown on the plan. The present output of the electric plant is about 1,000 incandescent and 50 arc lights. The coal burned amounts to about 24 tons of Spring Valley screenings in 24 hours.

The entire plant is under the direct supervision of Mr. G. H. Thayer, Superintendent of Telegraph, and was built under the direction of Mr. C. K. MacFadden. For the particulars of the plant we are indebted to Mr. A. J. Farrelley, who is in immediate charge.

The Recent Survey of St. Louis.

This was thoroughly described in a paper read recently before the Engineers' Club of St. Louis by Mr. B. H. Colby, Engineer in Charge of Surveys, Sewer Department.

The survey was undertaken in order to perfect plans for the drainage of the city, but it was of such a character that the results will be available for estimates on all public improvements. The work may be divided into triangulation, hypsometric survey and topographical survey.

Triangulation.—The base line is one of the triangle sides of the recent Government Survey of the Mississippi, lying entirely within the city limits. The necessary co-ordinates were thus predetermined. Its length is very nearly six miles. The triangulation stations were distributed, in order to obtain the best results geographically, as evenly as possible, with a view also of connecting old city surveys and beginning new ones. For stations recourse was had to the parks, cemeteries and roofs of buildings, both public and private. There were established 87 stations in an area of 27,771.5 acres, that comprised between the limits of 1870 and the present ones. Angles were read from all stations except three, which were inaccessible.

Owing to the presence of smoke, a steadily flashed heliotrope was used for a target and a V-shaped board, painted white, inserted in a leg of the tripod, relieved by a background of black cloth, when the sun was obscured. The average closure of triangle was 2m. 7s. with heliotrope, 4m. 6s. with targets; average 3m. 7s. Adjustment by least squares was not applied owing to the frequent reference to the base line and the compactness of the work.

Hypsometric Work.—This was done with a Fauth precise level, and rods made by Kern, in Switzerland, by methods used by the U. S. Assistant Engineers; 743 benches, 12 per square mile, have been established over the entire city. All stretches have been duplicated in opposite directions, the total distance completed in duplicate being 240 miles. The probable error in determining a single mile of work was found to be ± 0.001′.

Topography.—The co-ordinates of this survey are based upon the geodetic latitudes, longitudes and azimuths of the triangulation. Vertical heights are derived from the precise level benches.

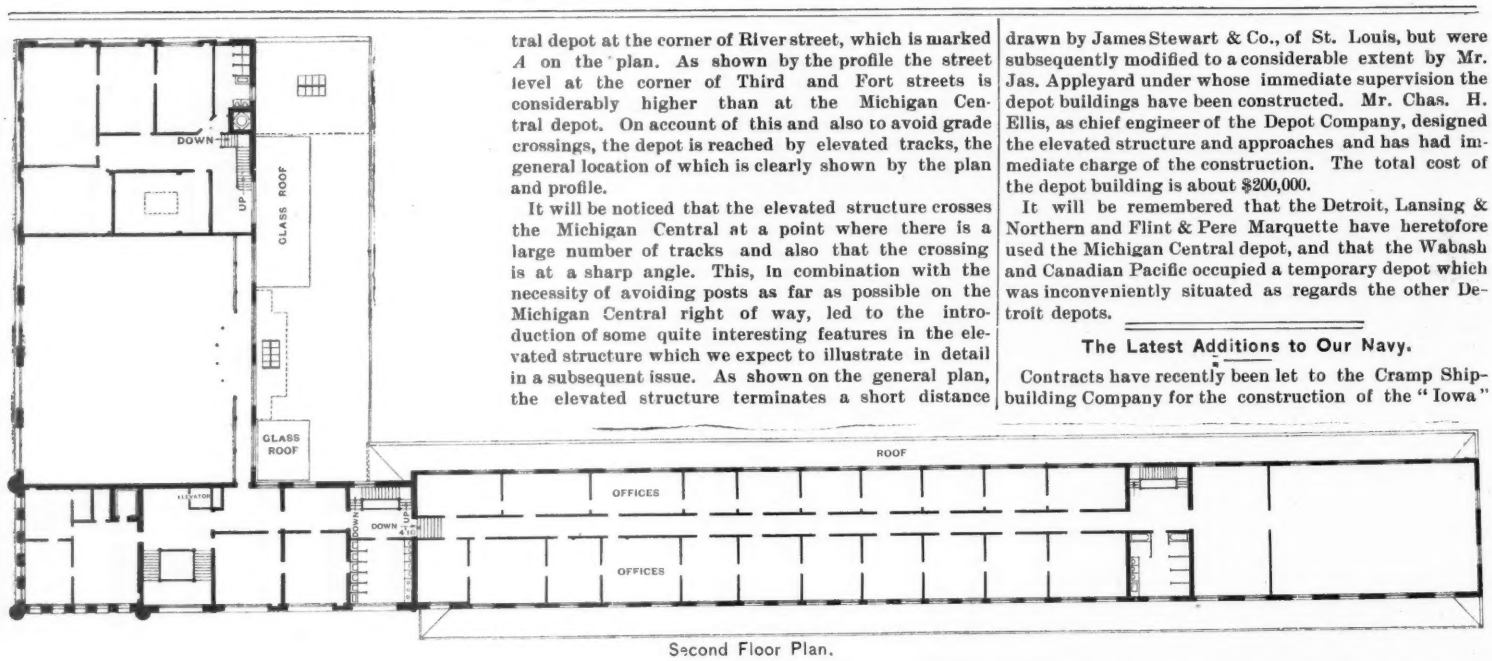
Starting from the triangulation stations, lines have been run with theodolite and stadia over the 28,000 acres which mark the growth of the city since 1870. The city directrix was taken as zero, and contours in multiples of 3 ft. above and below this datum have been mapped. The distances between stadia stations and vertical angles have always been read in both directions. Notes were taken almost entirely without sketches under a system that proved both rapid and effective. The telemeters read in meters in order to make use of Ockerson's Tables, which give the difference of elevations between two points in feet, when the vertical angle is known and their distance in meters.

In plotting points, of which no less than 111,304, four to an acre, have been determined, a metal protractor specially designed for plotting by polar co-ordinates is used. An average day's work with this is 750 points.

Up to Nov. 1, 1892, the work, including office work, has cost:

			Per acre.
Topography	(occupied 471 days)	$20,503.59	$0.732
Precise levels	(" 250 ")	10,890.31	0.277
Triangulation	(" 91 ")	4,079.43	0.145
	815 days*	$35,473.33	$1.144

* Does not include 218 days office work.



Second Floor Plan.

Mr. Colby's paper describes many valuable and practical methods and suggestions developed in the course of the work, and is recommended, therefore, to the attention of engineers engaged in work of a similar character. It will appear in the *Journal of the Association of Engineering Societies* for January, which will be issued in about two weeks.

The Fort Street Union Depot, Detroit.

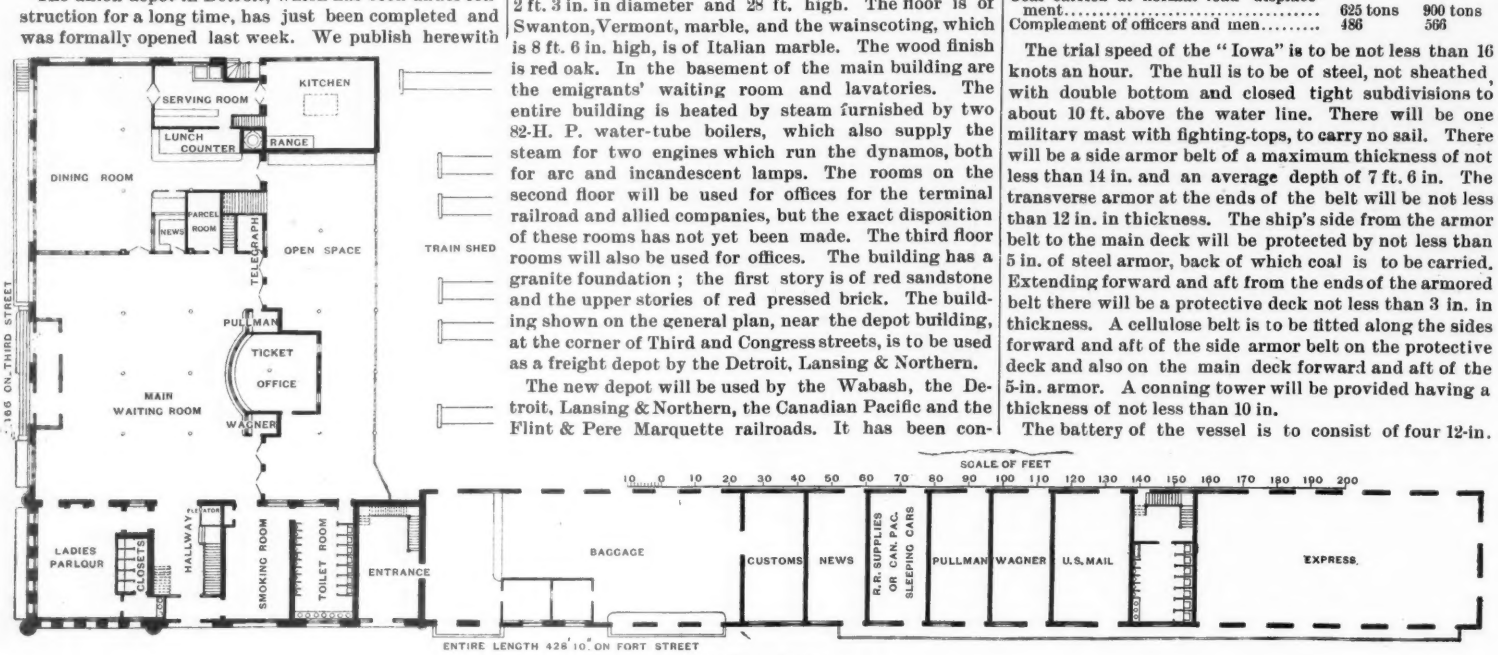
The union depot in Detroit, which has been under construction for a long time, has just been completed and was formally opened last week. We publish herewith a plan showing the site of this depot, plans of the main and second floors, and a view made from a photograph taken for the *Railroad Gazette*. From the general plan of the location it will be seen that the new depot, marked *B*, is on the corner of Fort street and Third street, and is therefore about three blocks from the Michigan Central depot at the corner of River street, which is marked *A* on the plan. As shown by the profile the street level at the corner of Third and Fort streets is considerably higher than at the Michigan Central depot. On account of this and also to avoid grade crossings, the depot is reached by elevated tracks, the general location of which is clearly shown by the plan and profile.

It will be noticed that the elevated structure crosses the Michigan Central at a point where there is a large number of tracks and also that the crossing is at a sharp angle. This, in combination with the necessity of avoiding posts as far as possible on the Michigan Central right of way, led to the introduction of some quite interesting features in the elevated structure which we expect to illustrate in detail in a subsequent issue. As shown on the general plan, the elevated structure terminates a short distance south of Sixth street, the tracks at the depot and in the yard being on solid ground.

Referring to the plans of the depot building, it will be seen that the head house has a width on Third street of 160 ft., and that the entire length along Fort street is 428 ft. 10 in. The proposed distribution of the rooms on the main floor is so clearly shown on the engraving that little description is necessary. The general waiting room is 70 ft. square and 29 ft. in height, being two stories high. A noticeable feature of this room is the six columns, 2 ft. 3 in. in diameter and 28 ft. high. The floor is of Swanton, Vermont, marble, and the wainscoting, which is 8 ft. 6 in. high, is of Italian marble. The wood finish is red oak. In the basement of the main building are the emigrants' waiting room and lavatories. The entire building is heated by steam furnished by two 82-H. P. water-tube boilers, which also supply the steam for two engines which run the dynamos, both for arc and incandescent lamps. The rooms on the second floor will be used for offices for the terminal railroad and allied companies, but the exact disposition of these rooms has not yet been made. The third floor rooms will also be used for offices. The building has a granite foundation; the first story is of red sandstone and the upper stories of red pressed brick. The building shown on the general plan, near the depot building, at the corner of Third and Congress streets, is to be used as a freight depot by the Detroit, Lansing & Northern.

The new depot will be used by the Wabash, the Detroit, Lansing & Northern, the Canadian Pacific and the Flint & Pere Marquette railroads. It has been constructed by the Fort Street Union Depot Company, which has no direct connection with the railroad companies which will use the depot, although the stock is so divided that it is held in nearly equal amounts by gentlemen who are individually interested in the four railroads above mentioned. The original plans of the depot were drawn by James Stewart & Co., of St. Louis, but were subsequently modified to a considerable extent by Mr. Jas. Appleyard under whose immediate supervision the depot buildings have been constructed. Mr. Chas. H. Ellis, as chief engineer of the Depot Company, designed the elevated structure and approaches and has had immediate charge of the construction. The total cost of the depot building is about $200,000.

It will be remembered that the Detroit, Lansing & Northern and Flint & Pere Marquette have heretofore used the Michigan Central depot, and that the Wabash and Canadian Pacific occupied a temporary depot which was inconveniently situated as regards the other Detroit depots.



Main Floor Plan.

FORT STREET UNION DEPOT, DETROIT, MICH.

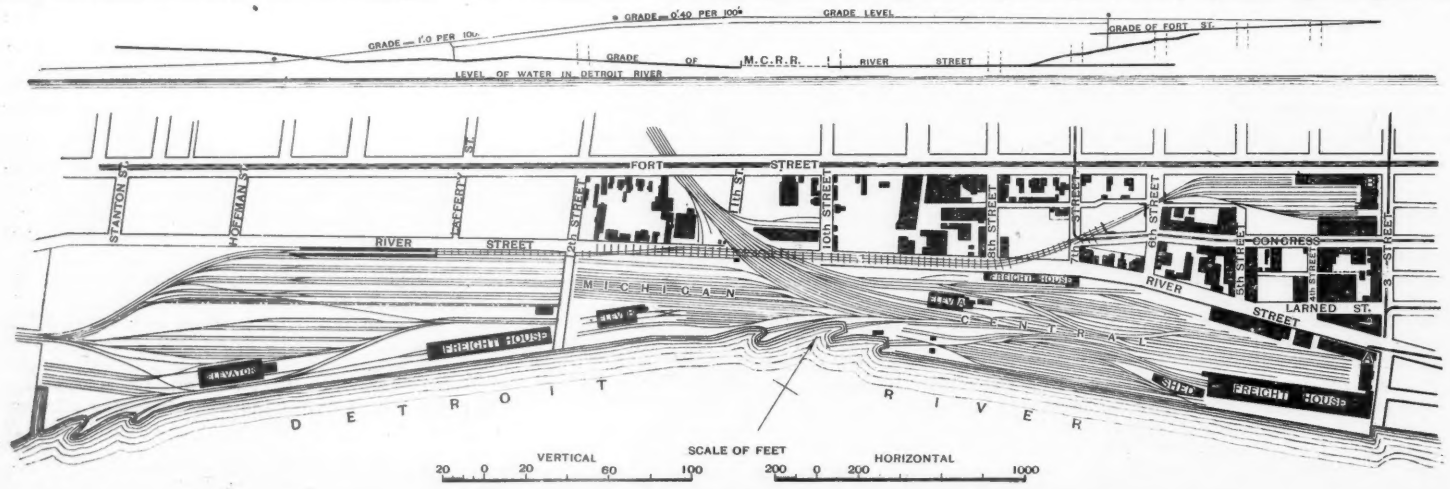
The Latest Additions to Our Navy.

Contracts have recently been let to the Cramp Shipbuilding Company for the construction of the "Iowa" and the "Brooklyn," which, when finished will be the finest examples of naval architecture and marine engineering in their respective classes of battleship and armored cruiser which have ever been built in this country. The principal particulars of these two ships are as follows:

	"Iowa."	"Brooklyn."
Length on load water line	360 ft.	400 ft. 6 in.
Molded breadth at load water line	72 ft.	64 ft.
Mean draft at normal displacement	24 ft.	24 ft.
Displacement, about	11,290 tons	9,150 tons
Total coal capacity	1,975 tons	1,650 tons
Coal carried at normal load displacement	625 tons	900 tons
Complement of officers and men	486	566

The trial speed of the "Iowa" is to be not less than 16 knots an hour. The hull is to be of steel, not sheathed, with double bottom and closed tight subdivisions to about 10 ft. above the water line. There will be one military mast with fighting-tops, to carry no sail. There will be a side armor belt of a maximum thickness of not less than 14 in. and an average depth of 7 ft. 6 in. The transverse armor at the ends of the belt will be not less than 12 in. in thickness. The ship's side from the armor belt to the main deck will be protected by not less than 5 in. of steel armor, back of which coal is to be carried. Extending forward and aft from the ends of the armored belt there will be a protective deck not less than 3 in. in thickness. A cellulose belt is to be fitted along the sides forward and aft of the side armor belt on the protective deck and also on the main deck forward and aft of the 5-in. armor. A conning tower will be provided having a thickness of not less than 10 in.

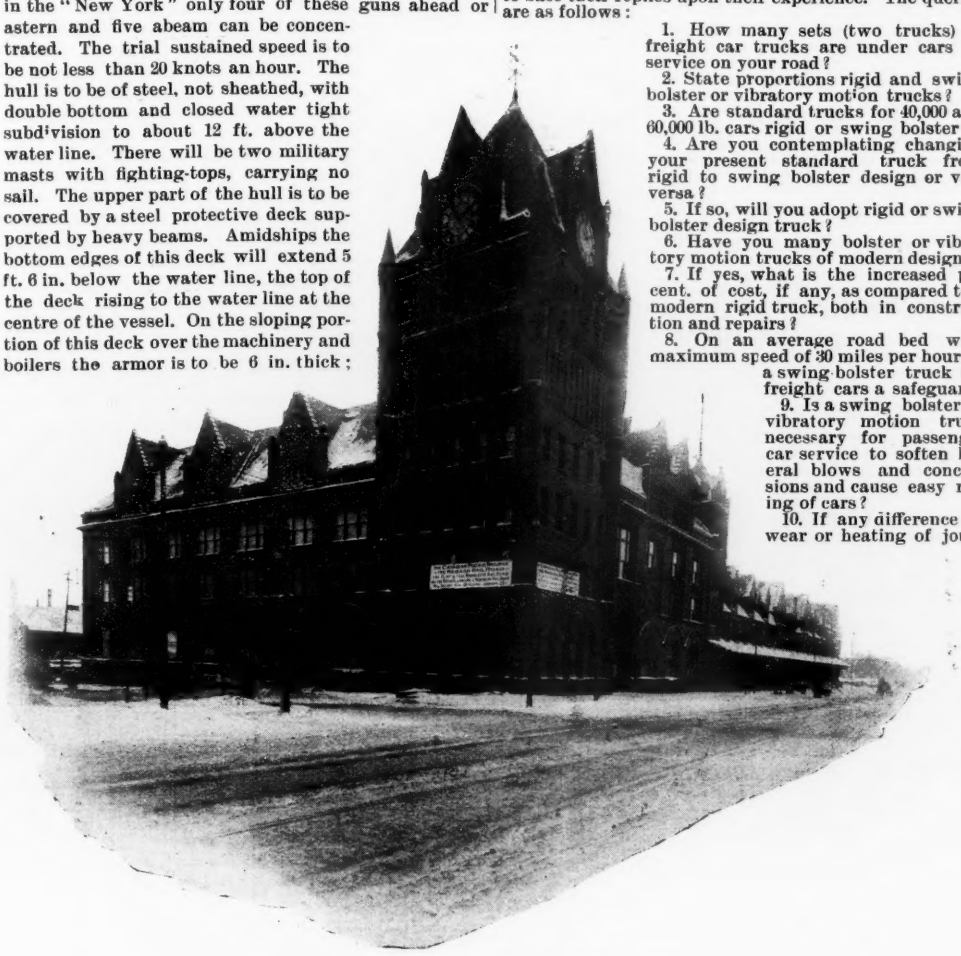
The battery of the vessel is to consist of four 12-in. breech-loading rifles, which are to be mounted in two barbette turrets, placed one forward and one aft, on the centre line of the vessel; eight 8-in. breech-loading rifles, which are to be mounted in four barbette turrets, placed two on either broadside of the vessel; six 4-in. rapid fire guns; twenty 6-pounder rapid fire guns; four



Map and Profile of the Fort Street Union Depot Company's Railroad, from Eighteenth to Third Street, Detroit, Mich.

1-pounder rapid fire guns; four machine guns; and one field gun. The 12-in. guns are to be capable of firing through an arc of 270 deg., and the 8-in. guns in each turret are to be capable of firing through an arc of 170 deg. There will be seven torpedo tubes and provision for resisting torpedo attack will be in the form of steel ring nets carried by swinging booms. The main engines are of the vertical, triple expansion type of about 11,000 I. H. P. and will drive twin screws. There are five boilers, three of which are double ended and two single ended.

The "Brooklyn" is an armored cruiser of the same general design as the "New York." The most noticeable improvements as compared with the "New York" are the addition of a forecastle deck, the raising of the heavy guns forward a distance of 8 ft., enabling them to be fought in any weather, an alteration in the lines amidships in order that a complete fore and aft fire may be obtained from the broadside turret guns, an increased battery arranged so that it is possible to concentrate the fire of six 8 in. guns ahead, astern, or abeam, whereas in the "New York" only four of these guns ahead or astern and five abeam can be concentrated. The trial sustained speed is to be not less than 20 knots an hour. The hull is to be of steel, not sheathed, with double bottom and closed water tight subdivision to about 12 ft. above the water line. There will be two military masts with fighting-tops, carrying no sail. The upper part of the hull is to be covered by a steel protective deck supported by heavy beams. Amidships the bottom edges of this deck will extend 5 ft. 6 in. below the water line, the top of the deck rising to the water line at the centre of the vessel. On the sloping portion of this deck over the machinery and boilers the armor is to be 6 in. thick; on the horizontal portions it is to be 3 in. thick, and forward and aft of the machinery it is to be not less than 2½ in. thick. In the region of the water line the hull is to be protected by an armor belt 3 in. thick and 8 ft. 3 in. wide. Within this armor belt and above it, a belt of cellulose 3½ ft. wide is to extend the whole length of the vessel. As a further protection coal will be carried above the armored deck for a length corresponding to that of the inner bottom. The conning tower will have armor not less than 7½ in. thick.



The Fort Street Union Depot—Detroit, Mich.

The battery of the vessel is to consist of eight 8-in. breech-loading rifles of 35 calibers, twelve 5-in. rapid fire guns, twelve 6-pounder rapid fire guns, four 1-pounder rapid fire guns, four machine guns, and two field guns. The 8-in. guns are to be mounted in four barbette turrets placed one forward and one aft on the centre line of the vessel, and one on either side of the vessel amidships. The middle guns will fire through an arc of 310 deg. and the broadside guns through an arc of 180 deg. The barbettes will be covered with 8-in. armor, and the turrets which revolve inside of them will have 5½ in. armor. The 5 in. guns are to be protected by fixed segmental shields 4 in. thick. There will be five torpedo tubes and steel ring nets the same as described for the "Iowa." The machinery is to consist of four triple expansion engines of the usual vertical type, working in pairs on two shafts, and five double ended and two single ended boilers. The estimated horse power of the main engines with the air and circulating pumps is about 16,000. The engines are coupled so that the forward engine on each shaft can be disconnected.

The policy of the present administration has been to distribute the work of shipbuilding as much as possible, and it is now being carried on in Bath, Me., Elizabethport, N. J., New York, Philadelphia, Baltimore, Chicago, San Francisco and at a port in Wisconsin. The development of shipbuilding in California has been rapid, one of the great advantages being the climate, which makes it possible to carry on work throughout the year. The chief disadvantage is the distance that much of the material must be hauled, as the armor plates are all made *in* the East. In spite of such disadvantages the work on the Pacific Coast has been carried out quite as rapidly as in the Eastern yards.

Freight Car Truck Frames.

The Committee of the Master Car Builders' Association on freight car truck-frames has just issued a circular asking for information on this important subject. The questions which are given below in a slightly condensed form appear to cover the subject very completely and if the replies are as explicit and direct as the queries a flood of light will be thrown upon the behavior of freight car trucks-frames average life, and the relative merits of the different styles of trucks in use. It is to be hoped that the information obtained from the replies will materially assist in improving the design of car trucks and standardizing those details that general experience has shown to be the best. In each case where an opinion is asked the members are requested to base their replies upon their experience. The queries are as follows:

1. How many sets (two trucks) of freight car trucks are under cars in service on your road?
2. State proportions rigid and swing bolster or vibratory motion trucks?
3. Are standard trucks for 40,000 and 60,000 lb. cars rigid or swing bolster?
4. Are you contemplating changing your present standard truck from rigid to swing bolster design or vice versa?
5. If so, will you adopt rigid or swing bolster design truck?
6. Have you many bolster or vibratory motion trucks of modern design?
7. If yes, what is the increased per cent. of cost, if any, as compared to a modern rigid truck, both in construction and repairs?
8. On an average road bed with maximum speed of 30 miles per hour, is a swing-bolster truck for freight cars a safeguard?
9. Is a swing bolster or vibratory motion truck necessary for passenger car service to soften lateral blows and concussions and cause easy riding of cars?
10. If any difference in wear or heating of journals and journal bearings, is it in favor of rigid or swing trucks?
11. Are swing-bolster trucks of modern design more severe on the bolster springs than rigid trucks?
12. If any marked difference in the breakage or wearing of wheel flanges or treads, is it in favor of rigid or swing-bolster trucks?
13. If swing bolster trucks decrease wear of wheel flanges, brasses, journals and track, and carry car body more steadily than rigid trucks, would you adopt them for freight cars, provided the cost of construction and maintenance was not higher than that of rigid trucks?
14. Are truck check chains a safeguard in derailments?
15. State preference as between pressed steel, malleable, and cast iron centre plates.
16. Are pressed steel chafing plates on swing bolster and truck transom more economical than gray or malleable iron?
17. In a 4-wheel freight truck, 6 ft. 3 in. between centres of arch bars, for 60,000-lb. cars, how far apart do you place centres of side bearings and centres of truck springs?
18. Do your truck bolsters spring down at the centre, requiring centre plate to be frequently blocked up, to allow free motion between side bearings?
19. In a trussed wood bolster do rods elongate or break, both in your own and foreign cars, causing truck bolster to sag down at the centre when cars are slightly overloaded?
20. If you use a plain double trussed oak bolster, do the truss rods rest centrally on a single block in the saddle or on a king post? and do the truss rods pass through to the end of the bolster or rest on a shoulder inside of truck frames?
21. Give distance from centre to center of bolster, king posts, and depth or length of post or block.
22. Do compound bolsters composed of two or more iron or steel plates, applied edgewise and bolted together between timbers, become defective on account of the timbers shrinking, causing the transverse or packing bolts to become loose, thus destroying a large per cent. of solidity of the bolster, until bolts are again tightened up?
23. What are the extreme length, depth and thickness of web and flanges of your iron or steel channel bar truck transoms for 40,000 lb. and 60,000-lb. cars?
24. Are your channel bars, either flatwise or edgewise, bolted or riveted to the intervening column or truck end castings?
25. Give size and number of bolts or rivets applied to each end of channel bar, and state preference.
26. Give number of parts, including wheels and axles, wood and lag screws, washers, nuts, bolts, rivets and all other parts, in one of your trucks of 60,000 lbs. capacity, and also trucks of 40,000 lbs. capacity.
27. Are trucks with timber transoms and bolsters expensive to maintain on account of wood shrinking and warping?
28. Is an iron or steel truck cheaper to maintain than a wooden truck?
29. What is the proper wheel base for a four-wheel freight truck, 4 ft. 8½ in. gauge?
30. Assuming 5 ft. as the maximum wheel-base, of what size bar iron would you make the top and bottom arch bars and tie strap, in a 60.000 lbs. capacity truck, with a camber of 15 to 18 in. between arch bars?
31. What size would you recommend for the diameter of truck column bolts for cars of 60,000 lbs. capacity?
32. To secure column and oil box bolts, do you prefer double nuts or one nut secured by round spring cotter or tapered flat split key for each of these bolts, or do you prefer nut lock?
33. In securing single nuts with spring cotters, do you have difficulty in getting spring cotter to lock against the nut closely, on account of the varied distance caused by shrinkage of castings?
34. Are you in favor of inside brakes suspended to the truck frame, or outside brakes suspended to car body?
35. Are metal brakebeams more economical than double-trussed wood beams on trucks under cars equipped with air brakes?
36. Have you had any experience or made any personal observation enabling you to form a sound opinion as to the merits of the pressed steel truck frame illustrated on pages 38 and 39 of M. C. B. A. Report of 1891? and, if so is your opinion favorable or unfavorable?
37. Provided a pressed steel truck frame can be made as claimed, cheaper, lighter and stronger than the strongest "Diamond" frame, do you consider the form of side part objectionable as not admitting of a low-down car body when required, like a properly constructed "Diamond" frame?
38. Should truck springs be placed upon the oil boxes or upon a central spring plank or bolster?
39. Is the space provided in the pressed steel truck for spiral truck springs large enough for springs of sufficient capacity for 60,000-lb. cars?
40. Is it objectionable in a pressed steel truck frame to have the transoms and side arches riveted together?
41. Would the pedestal jaw of the pressed steel truck, illustrated, make it more difficult to remove and replace wheels than with the arch bar side frame?
42. State any other consideration adverse to or in favor of the pressed steel truck frame.
43. If pressed steel rigid truck frames prove satisfactory for certain classes of freight cars, is it not desirable that a similar truck be designed for the use of elliptic springs and vibratory motion, for palace stock cars, express refrigerator and other special freight cars?
44. In a swing bolster truck, what distance or limit of the swing motion of bolsters do you allow between each end of bolster and intervening truck transom castings or frames?
45. In a swing motion truck, do you apply truck hanger bracing by setting the lower end in or out, or in a plumb line? If in or out, state distance from plumb line.
46. State dimensions of plain oak (not trussed) truck bolsters in your rigid or swing truck for cars of 40,000 lbs. capacity.
47. As truck bolsters receive the weight of car and load direct, and cannot be repaired or adjusted without detention to the car to remove the truck, is it not important that truck bolsters be constructed with a greater factor of wear and safety?
48. Can you recommend any particular style, make or material for dust guards?
49. Is the standard M. C. B. journal box, lid, brass and key, satisfactory?
50. Are wrought-iron or steel freight trucks more economical than trucks constructed of gray (cast-iron) iron and wood transoms and bolsters?

Address replies to J. C. Barber, Chairman of Committee, St. Paul, Minn.

Railroad Commissioners' Reports.

CONNECTICUT.

The Railroad Commissioners of Connecticut—George M. Woodruff, William H. Hayward and William O. Seymour—have issued the fortieth annual report of the board for the year ending Dec. 31 last. The returns of companies are for the year ending June 30, 1892. The roads of the state are now operated by five companies, or, practically speaking, four—the fifth company operating only 2¼ miles. The taxes paid to the state of Connecticut during the year were $765,639, being 35 per cent. of all the taxes received by the state. The length of road in the state is the same as a year ago—1,006 miles. The casualties are given as follows:

	Killed.	Injured.
Passengers	2	21
Employés	59	379
Trespassers	102	56
Others	22	27
	185	483

The New York, New Haven & Hartford has eliminated 15 grade crossings of highways during the past year. A large portion of the report is taken up with accounts of proceedings in highway-crossing cases. The New York & New England and the Philadelphia, Reading & New England have been complained of for running trains on Sunday and the State Treasurer will sue them for the penalties.

Express Business at Christmas.

Christmas "rushes," in the light of the last two years' experiences, may now be considered events of past history. While the volume of Christmas traffic handled by the express companies in the United States during the late holiday season was, from all reports, the largest ever handled, yet, so thoroughly has the service been systematized that at no single point was there any burdensome rush or vexatious delay either before or during the usually heavy days immediately preceding Christmas Day. In this happy state of affairs the express companies have been greatly aided by the growing tendency of the general public of sending their Christmas packages earlier in the season. . . .—*Express Gazette.*

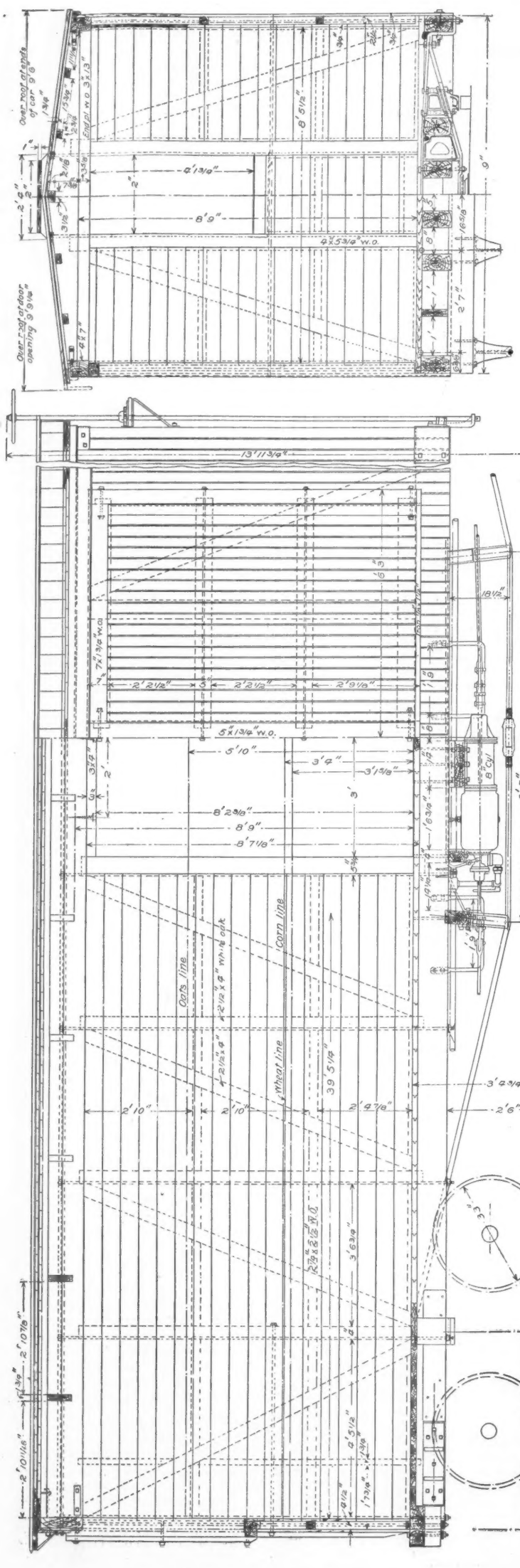


Fig. 1.

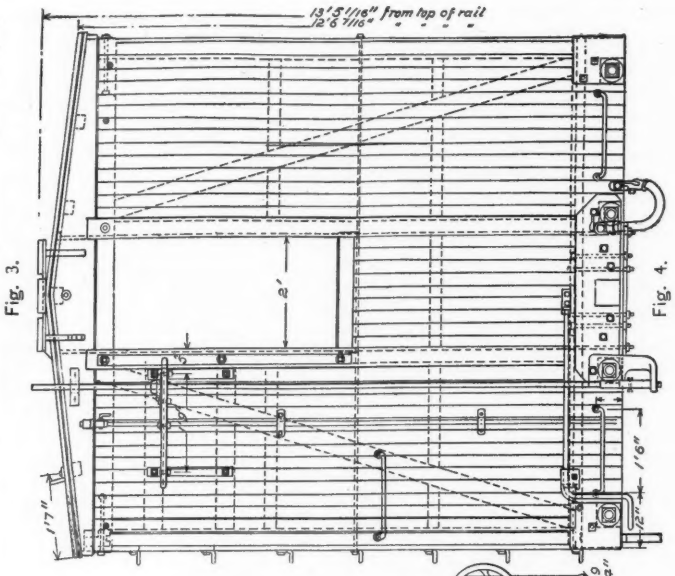


Fig. 3. Fig. 4.

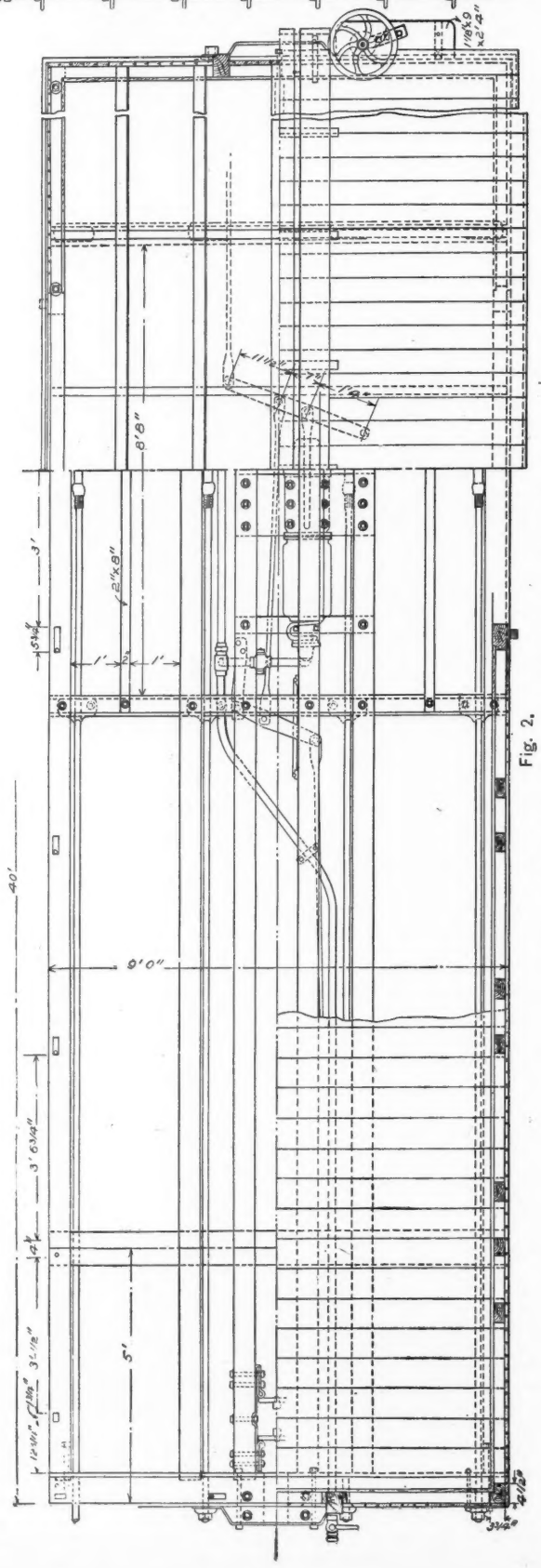


Fig. 2.

40-FT. FURNITURE CAR; CAPACITY, 50,000 LBS.—CHICAGO, BURLINGTON & QUINCY RAILROAD.

The Chicago, Burlington & Quincy Furniture Car.

The Chicago, Burlington & Quincy new design of freight car has attracted considerable attention, not only on account of its novel construction, but also because it has probably greater carrying capacity for equal length, height and weight than any other freight car built in this country. It may be taken as a good example of the most modern American freight car. It has the low sill construction, described in the *Railroad Gazette* Jan. 29, 1892. On the subject of low centre sills we have written emphatically before this, firmly believing as we do that the most practical, as well as the most scientific, location for the drawbar is directly on the line of the sills, and this is the location provided in the designs now shown.

The illustrations show the 40-ft. furniture car on the C., B. & Q., which differs from the 34-ft. freight car in that it is longer and higher, but unlike most furniture cars it is built of sufficient strength for 50,000 lbs. capacity. This design has been in service nearly two years, and a considerable number have been built. The designs have been checked up by actual experience and repairs, until now the designers feel assured that for the present, at least, the details are in their best form.

In the *Railroad Gazette*, June 21, 1889, the standard 34-ft. car of the C., B. & Q. was illustrated, and from comparison it will be seen that this furniture car is a development from the standard box car with some important modifications. Figs. 1, 2, 3 and 4 show the side elevation, plan, cross section and end elevation.

The side bracing is shown in fig. 1. There are vertical posts and inclined braces. Beside each post there is a vertical rod ¾ in. in diameter, extending from the bottom of the side sill to the top of the plate. The posts are 4 × 2½ in. white oak. The braces are the same. The posts are tenoned in the side sills and are without metal bearing shoes on the sills and plates. These shoes are used in the 34-ft. box car and in stock cars, but not in furniture cars. There are two belt rails of white oak 2¼ × 2½ in. The interior of the cars are sheathed to the roof. The sheathing is nailed to the posts and braces. This gives greatly increased strength. On the interior of the cars the wheat, corn and oat line for the maximum carrying capacity is painted at the proper height. The end plates are of white oak 3 in. × 13 in., extending across the car at the top. The end doors are unusually large, having an opening 24 × 49¾ in. The end door sills are plated with iron ¼ × 3½ in. These doors slide vertically. The end posts at the centre are 4 × 5¾ in., and are made large to prevent bulging of the ends of the car.

In fig. 1 is shown the location of the draft gear. It is placed near the front in order to clear the truck. The plan, fig. 2, shows the design of the draft gear; it is one which the Burlington road has been using for the past two years. It is made of steel or wrought iron bent to the form shown and bolted laterally to the sills. The buffer block is protected by an angle plate, as shown in fig. 1.

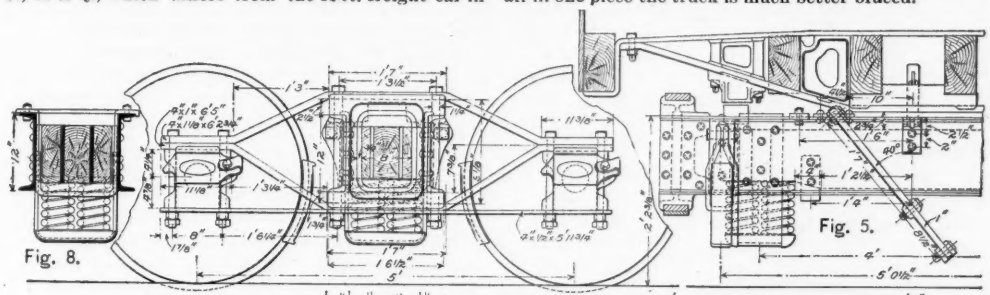
The truss rods are large and have an unusual amount of camber, and have large bearing plates on the end sills. There are four of these rods per car, as shown in fig. 3.

The body bolster is particularly interesting, as it is of novel construction. The top and bottom members of this bolster are formed at the ends to match together and to receive the side sills. All this is clearly shown in fig. 3.

The arrangement of the brake rigging and the general arrangement of the sills are so clearly shown in the plan, fig. 2, as to require no further description, except, perhaps, to say that the placing of the sills so close together at the centre, leaving a wide space at the side, has been found to be productive of good results. It has not been found to be necessary to use another intermediate sill on each side to fill up this wide space. Fig. 5 shows the body bolster more in detail.

Figs. 5, 6, 7, 8, 9 and 10 show the very interesting form of truck used under these cars. It will be remembered that a few years ago the Burlington road discarded swing bolsters for freight car trucks and adopted instead the ingenious arrangement of spring carriers, shown in figs. 5, 6, 7, 8 and 9.

The truck transoms are channels riveted securely to an end plate which is cast all in one piece, as shown in fig. 6. A considerable number of rivets are placed at this joint, as shown in fig. 5, between the channels and the end plate. By making the end casting all in one piece the truck is much better braced.



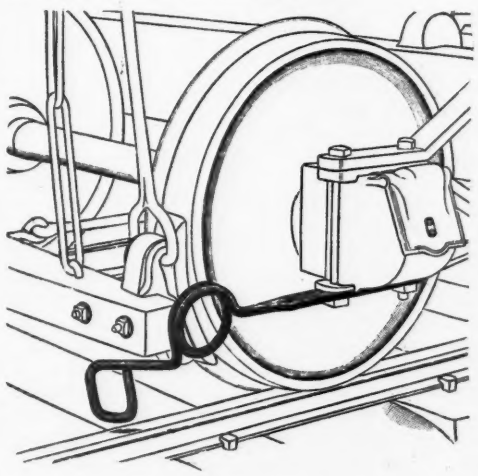
Truck No. 12, for 60,000-lb. Cars—Chicago, Burlington & Quincy Railroad.

The spring straps shown are made of a flat plate 7 in. wide by ½ in. thick, lipped over the top of the transom channels, as clearly shown in fig. 8. The truck bolster is made of plates of oak and wrought iron riveted together and is shown in fig. 9.

Altogether, this truck is worth some study, as it is one of the most durable, simple and efficient diamond freight trucks made in this country.

Clarke's Car Wheel Fender.

The accompanying illustrations represent a device recently introduced to save loss of life by persons being run over by cars, etc., when switching or moving slowly in yards and near stations. While it would probably be of little use at high speeds, where persons are generally killed by the impact and do not come under the wheels at all, it appears to be a very simple method of preventing the wheels passing over either adults or children at slow speeds and in situations where the majority of such accidents occur.



Steel Car Wheel Fender.

A piece of round spring steel in the form shown is placed just in front of the wheel and directly above the rail. The front part is formed into a loop placed obliquely to the rail, and therefore has a tendency to throw anything it strikes to the outside of the track. The coil provides elasticity so that the guard can yield without breaking on striking any solid obstruction.

It is claimed that it can be fixed without any change to any ordinary car truck. Any further particulars may be obtained of the makers, Messrs, Clarke Bros., Springfield, O.

Lake Superior Iron Ore Production.

The total iron ore brought to the market for the past 37 years from the Lake Superior ore beds has aggregated 73,248,796 gross tons. The shipments by ranges since the opening of the Lake Superior ore region, as given by the *Marine Review*, have been as below:

Ranges.	Gross tons
Marquette	37,917,591
Menominee	16,779,261
Gogebic	13,266,206
Vermillion	5,285,173
Mesaba	4,245
Miscellaneous	2,320
Total	73,248,796

The Gogebic and Vermillion ranges made their first shipments in 1884, and the Mesaba shipped its first two cargoes last fall. The output of last year added 9,074,243 gross tons to the above aggregate, or about one-eighth. For 1890 the shipments were 9,003,701, and for 1891 7,057,078.

The shipments by range, lake and rail for 1892 were:

Ranges.	Gross tons.
Gogebic	2,973,993
Marquette	2,666,856
Menominee	2,261,499
Vermillion	1,167,650
Mesaba	4,245
Total	9,074,243

And shipments by ports and all-rail for 1892 were:

Ports.	Gross tons.
Escanaba	4,010,085
Ashland	2,223,683
Two Harbors	1,165,076
Marquette	1,026,338
Gladstone	115,886
Superior	4,245
All-rail	528,930
Total	9,074,243

The census valuation of this ore for the census year 1890 was $2.66 on cars or carts at the mines (as against an average for all the ore mined in this country of $2.30). If we apply this valuation to the average yearly shipments for the past three years we shall obtain a yearly value of about twenty-two and a third million dollars. The capital invested in handling this product, as determined by Mr. George H. Ely and announced by him at the Paris Congress on International Navigation last summer, was as below:

Total capital		$175,394,98
Capital in mines in the four Lake Superior districts in 1889, as per United States Census	$54,825,122	
Increase to July 1, 1892	15,000,000	69,825,122
Capital in docks and their equipments at Lake Superior and Lake Michigan ports, built and used exclusively for shipping ore (official)		9,885,665
Capital employed exclusively in railroad transportation of ore from mines to shipping ports on Lake Superior and Lake Michigan (official)		27,014,594
Floating capital on the lakes, employed exclusively in ore transportation, from upper lakes to lower lake ports (estimated)		29,933,107
Capital in docks, and in their equipments, for receiving and forwarding ore exclusively, at Lake Erie ports between Toledo and Buffalo, inclusive of both (official)		12,392,880
Capital employed exclusively in railroad transportation of ore inland to mills and furnaces from Lake Erie ports (official)		26,343,617

It will be noticed that the assumed annual value of the product is about 12 per cent. of the capital invested in mining and transporting it to the furnace. The Lake Superior ore furnishes about one-half our iron and almost half of our lake freights.

Railroad Concessions in Venezuela.

The present government of Venezuela has considered it necessary to lay down certain conditions under which all future concessions for railroads in that republic will be granted. Accordingly a series of resolutions has been adopted and they are confirmed by Sr. Joaquin Crespo, Chief of the Executive, and by the Minister of Public Works, Sr. J. Muñoz Tébar, and we give below a summary of those resolutions.

The government will not stipulate any fixed time for the life of a concession, for the grant is considered as the property of the concessionary and given to him in perpetuity. The government will give for a certain number of years the exclusive privilege of transportation in a certain zone on both sides of a railroad. After the lapse of the time agreed upon, the government may extend this monopoly if it seems to be for the public interest. Concessions will be given to proper companies or individuals, either national or foreign. The company will neither contribute any capital nor guarantee any interest. Tariff rates must be agreed upon by the government and may be modified whenever the necessities of traffic demand modification. The gauge must be 1.07 metres; grades not more than 3 per cent. and minimum radius of curves 75 metres. The government will give to the railroad company the ownership of the land necessary for its operation, and it may grant larger quantities of public lands on either side of the railroad, but such grants will not be made in continuous strips. The largest area to be granted in any one piece, outside of the right of way, will be 25 square kilometres. The government will take proper steps to insure the completion of any railroad within reasonable, stipulated time. Concessions cannot be transferred to any foreign government, and legal questions must be decided in the courts of the Republic. Railroad companies to be established in the future must pay to the national treasury 5 per cent. of their net earnings. Railroad companies now existing may reform their concessions in accordance with these resolutions.

RAILROAD GAZETTE

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EDITORIAL ANNOUNCEMENTS

Contributions.—*Subscribers and others will materially assist us in making our news accurate and complete if they will send us early information of events which take place under their observation, such as changes in railroad officers, organizations and changes of companies in their management, particulars as to the business of the letting, progress and completion of contracts for new works or important improvements of old ones, experiments in the construction of roads and machinery and railroads, and suggestions as to its improvement. Discussions of subjects pertaining to* ALL DEPARTMENTS *of railroad business by men practically acquainted with them are especially desired. Officers will oblige us by forwarding early copies of notices of meetings, elections, appointments, and especially annual reports, some notice of all of which will be published.*

Advertisements.—*We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay,* EXCEPT IN THE ADVERTISING COLUMNS. *We give in our editorial columns* OUR OWN *opinions, and those only, and in our news columns present only such matter as we consider interesting, and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes etc., to our readers can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially, either for money or in consideration of advertising patronage.*

We ask the attention of our readers to an article on another page, on the fall of a trestle, written by a well known consulting engineer of New York City, whose name and the name of the railroad concerned are, for very obvious reasons, withheld. This road is in a frequently traveled section of the country, and is, we regret to say, not the only example of similar construction to be found. Promoters in endeavoring to get lines constructed will employ incompetent engineers, and will continue to erect skin structures in spite of all warnings, but there is one class who can and who should be reached by the warning that this article conveys, and that class is the operating officers of the roads already constructed. If they have not already in their employ persons competent to examine the structures on their roads, they can easily get the services of experienced engineers to make sure that they have no death traps, such as the writer has described. It is an interesting fact to state in connection with the wrecked structure that by arranging the spacing of the bents more economically, a wooden structure could have been erected instead of the one that fell, with split posts, caps and sills, so that any member could have been taken out at any time, which would have had a strength far in excess of the wrecked trestle, with the use of less than 10 per cent. more material.

The Northern Pacific Railroad Company received a lot of engines in 1890 with 62-inch driving wheels and cylinders 19 × 24 in. The wheels of these engines are being changed to 51 in., and the cylinders to 19½ in., with the same stroke. The cylinders were made originally thick enough to stand reboring. This change has given the engines greater apacity, and 24 cars can now be hauled on divisions where 18 was the limit before. This is an interesting evidence of the fact that in some cases locomotives have been built with too small cylinders. Evidence has been coming in during the past two years that when the reduction in cylinder volume was made in locomotives in this country about five years ago, it was carried too far by some, and it has been found that the single expansion locomotives which have the largest cylinders make the best showing in competition with compounds. Probably this results from the greater expansion obtained with the larger cylinders. It has become quite evident from certain notable cases that the size of the cylinders is not entirely independent of the work to be done, and locomotives working on heavy grades should have considerably larger cylinders than engines of the same weight used on comparatively level track.

The discussion, which will be found on another page, of Mr. Barr's paper on "Lubrication," before the Western Railway Club, is particularly valuable as still further emphasizing the leading idea of Mr. Barr's paper, viz., the importance of thorough supervision on railroads. Mr. Waitt had accomplished a considerable saving in the cost of lubrication by the substitution of wool waste in place of cotton, and solid brasses for shell brasses, while Mr. Barr's improved results had followed a change diametrically opposed to this, the obvious conclusion being that supervision is more important in this case than the exact character of the material used. These two roads used the same oil. Mr. Barr reiterated the statement made in his paper that a very small portion of the space in technical journals was given to the use of materials, compared with that given to new designs and specifications. This, of course, is a question of degree, and when Mr. Barr takes to editing he will find that there are more "variables" in the world than he even suspects now. The speakers at this meeting agreed that comparative statements of the expenditures on different roads could lead to no good result, as all the local conditions of loading, ballast, etc , could not be taken into consideration and the proper weight given to each factor. If the officers of the roads themselves cannot make these allowances to their own satisfaction, it is hardly to be expected that an editor can; and yet, without such allowances, we have left simply statements of performance which may be misleading and we believe would be uninteresting to the majority of the readers of the technical journals. On the other hand, however, good results are sure to follow the discussion of these economic questions, even if the incomplete comparisons which can be made are somewhat unsatisfactory and possibly sometimes disagreeable. It will not do, of course, to compare a road running west from Chicago with one running out of Boston. But divisions on roads in the same section of the country can be selected on which the differences in the local conditions are comparatively small, and a comparison of expenditures on such divisions will probably lead to good results. But if one-tenth of the space in a weekly railroad paper were regularly given to the discussion of such statistics, we fear that even Mr. Barr would find it uninteresting reading.

A suggestion has been made that safety chains should be used to supplement the ordinary draw gear between freight cars. It is assumed that the addition of safety chains would materially reduce the frequency with which trains break in two. Practical experience on a large scale with safety chains, however, is entirely against their use, chiefly because they nearly invariably break when the main coupling parts, especially when this occurs on a heavy grade or when the train is running at some speed. They are thus utterly useless just when they are most wanted. If the coupling parts and the chains hold in a slight snatch in a yard or passing over a sag the trainmen, especially at night, are unaware that anything has happened, and so the train proceeds until the first jerk breaks the far weaker safety chain. As this may happen on a heavy grade, far more serious consequences may ensue than if the train had entirely parted when the main coupling was broken. It is therefore better policy to invest the cost of safety chains in good draft gear made of good material. Safety chains have also the important disadvantage of largely increasing the time needed to couple or uncouple. This of course not only causes delay in switching, which is important, but largely increases the risk to life and limb in coupling cars. It may be added that while the use of safety chains in freight service has been rarely the practice in this country, they were at one time universally used in Great Britain. As, however, they proved not only utterly useless, but positively dangerous, their use has been entirely discontinued by every railroad in Great Britain. Of course it may be argued that should a draw bar be completely pulled out, safety chains would enable the train to be coupled up and proceed. But this would only be the case if the next car were also fitted with safety chains, and even then the safety chains would be very much weaker than the original coupling. A spare draw bar, or a length of stout chain carried on the tender or in the caboose, is not only cheaper but far more effective than the addition of four weak safety chains on every car.

The month of January promises to be no exception to the rule that cold and stormy weather greatly swells the train accident record. The severe conditions prevailing from Jan 10 to 22 were felt throughout the North, and in the South they were worse than for many years. Three notable collisions have occurred,* beginning with that near Meadows, the same place where a similar accident occurred on Oct. 18, 1885, when eight persons were killed. The lesson of this, like that of the earlier one, appears to be that human fallibility constitutes too large an element of weakness in the block system as used on American roads to be summarily set aside as an adverse condition that we cannot ameliorate. The liability of a signalman to make a simple and natural mistake which will cause an awful disaster is such a certainty that railroad managers are bound, notwithstanding the great safety of the simple block system—its vast superiority over the time interval system—to seek for still higher perfection. The officers of the Pennsylvania have not yet said which signalman is to blame, and we cannot say, indeed, but that this collision teaches one or more simple lessons in discipline that ought to be learned, regardless of what system is used. That was the case at Harrisburg last June and, as every one sees and deplores, it is the lesson in four-fifths of the bad collisions that occur. However defective our systems, we are constantly disregarding the lesson that more careful attention to discipline, and the payment of wages which would get and keep good men, would insure a very much higher degree of safety in spite of defects of systems. But aside from this, the position of the Pennsylvania before public opinion is a grave one. Its chief competitor is using block signals fitted with electric locks to provide against the blunder of operators. Electric safeguards of this kind have been tested for years and the time is coming, if it has not already come, when the burden of proof will rest—morally at least—on the road that does not use them on busy lines, to show why it does not. Trains are getting too thick on the Pennsylvania to admit of any temporizing.

It is true that the main criticism of the company in this case will be much mitigated by the fact that automatic track circuit signals are now being erected on the section of road where the collision occurred. As our readers know, these signals are being put in on about 30 miles of the New York division of the Pennsylvania. As these signals are going in where stations are close together and where the expense of employing an attendant at each signal would therefore be the most easily borne it must be assumed that the company sets a high value on the merits of automatic signals aside from the question of money saving. But automatic signals have not yet proved their right to be regarded as the equal of the Sykes system in all respects, and the equipment of 30 miles, or even a whole division, does not settle the question of safety on the Pennsylvania. The collision near Harrisburg will cause uneasy feelings among passengers who remember the recent similar case near the same spot. In view of this the questions asked on June 25, and still remaining unanswered, come up again; and apparently in about the same shape as then.

The third collision, that at Wann, Ill., would have been bad enough, considered by itself; but its secondary results are appalling. Secondary seems to be the proper word, for there could have been no excuse whatever for the presence of those people so near the dangerous oil cars; and we cannot see that the government, or the *Railroad Gazette*, or any one else ought to count those victims among the casualties from train accidents. We have not yet been able to clear up all the details of the disaster, but so far as we can learn, a number of loaded tanks burned up without exploding, and the frightful havoc was caused chiefly by one tank which had little or no vent. Evidently the oil was refined, and therefore, under all reasonable conditions, non-explosive. The old expedient of making a vent in a burning tank by firing a musket ball through it seems not to have been thought of. The serious feature of this catastrophe to railroad men is seen when we reflect that oil is now carried on every railroad and that the destruction of wrecks by fire is coming to be pretty common. Fires are bad enough, but if, in addition to that, we must contend with the risk of explosion, even with refined oil, cabooses will have to be equipped with firearms and trainmen will have to take a course of instruction in a school of musketry. But notwithstanding the fact that the collision was directly responsible for only one death the officers of the road will, of course, regret the results most deeply, without regard to the fine points of responsibility; and, we are bound to say, the lesson that they should learn is both old and simple. A distant signal, warning the engineman that that switch was wrong, and warning him in time to stop, would have cost less than $100. Five hundred such signals would have cost less than $50,000. Does any one care to go into the money question, in the presence of this disgrace to the road?

It appears to be necessary to take cognizance of a series of press dispatches from Watertown which

* See page 61.

have been widely printed, but which we have refrained from publishing because they bore evidence of the work of a "literary bureau," and their authenticity was not obvious. The most important statements contained in these dispatches were that officers of the New York Central had become interested in the ownership of the New York Air Brake Company, and that the New York air brake was to be largely used on the freight cars of the New York Central. We have taken considerable pains to get at the truth of these statements, and probably the whole of the truth is this: The New York air brake is not to be applied to the cars of the New York Central beyond the very few that are already equipped with it, but it is to be used on the freight cars of the Rome, Watertown & Ogdensburg. Those who know something of the inside facts as to the ownership of the stock of the New York company and as to public affairs in the State of New York do not need to go very far to find the influences which led the officers of the New York Central to agree to use this brake on the Rome, Watertown & Ogdensburg, and it is probably safe to say that those influences were not such as affected the personal interests of the railroad officers. There were grave reasons for helping the New York Air Brake Company, and while, of course, we do not know whether or not officers of the New York Central own any of this stock, we can see ample reasons for their action in the matter without attributing to them any motive of personal interest.

Reports from Washington indicate that the prospects of the Senate bill to legalize pooling are not hopeful. Senator Cullom is reported as saying that he does not expect any legislation on pooling this session, and the vote of his committee to postpone discussion of that clause seems to be taken as a final vote against the principle of pooling. The vote in committee was six to five, so that the decision in favor of leaving the law as it is is not overwhelming; but railroad men who have followed the discussions and the utterances of the members of the committee are discouraged by the general attitude of the members. The state of affairs in the House is no better. The committee in presenting the bill apparently were not of one mind or did not thoroughly understand each other and the measure cannot be said to have been fairly considered by the whole House. The bills designed to strengthen the Interstate Commerce law in various details other than pooling seem to have plain sailing, and the Senate Committee has adopted the following provisions: To define the word "line" as meaning a physical line, so as to carry out the plain intent of the long-and-short-haul section, applying it to any road or combination of roads where it may be desirable to prevent discrimination of the kind contemplated by the fourth section; to provide for the punishment of corporations for misdemeanors by fines not exceeding $5,000 each and to abolish the imprisonment penalties. This clause says that it shall be sufficient to serve a writ on a station agent (in the absence of a higher officer) within the judicial district where indictment is found. The Senate Committee also voted in favor of amending section 12 so as to compel witnesses to testify, etc.; any person neglecting or refusing to obey the subpœna or lawful requirements of the Commission to be guilty of a misdemeanor, punishable by a heavy fine; also to amend section 16 so that courts cannot admit new evidence in a case which has been before the Commission, unless the Judge is satisfied that the failure to present the evidence before the Commission is reasonably excusable. On Jan. 19 several bills were passed in the House, but it is not clear how closely they agree with the action and views of the Senate on the same subjects. One of these bills is to compel witnesses to testify, and another to define the word "line." The House definitely rejected the pooling feature, as intimated above, and then approved a bill presented by Mr. Boatner, of Louisiana, requiring all railroad common carriers to accept from connecting lines loaded cars or trains "to be hauled to the point of delivery at a rate not exceeding that they charge for similar service over their own lines." Just what this means remains to be seen.

It is reported from Chicago that Messrs. Walker and Blanchard have ordered the Michigan Central and the Chicago & Grand Trunk to divert some of their eastbound freight to the Chicago & Erie, and the report seems to be true. The reason for this early abandonment of the agreement to adjust differences between the competing roads by reducing the rates on the weaker lines does not appear, but the reporters are indulging in much guessing, and they hasten to inform us that the diversion order has not yet been complied with. Evidently the assent of the roads in Central territory to the differential scheme was not given with much enthusiasm. Mr. Walker must know something about the general feeling on the subject of diversion, for he tried it on the Southwestern roads; but that trial was not an encouraging one, if we may judge by the public utterances of those most interested. The present experiment will be still more interesting than that was, for the general subject is more clearly before men's minds. Diversion can be carried on, especially at such a place as Chicago, where there are many large shippers, without injustice to the public or to any shipper; but such an arrangement looks so much like a pool that the effect on public sentiment may be unfavorable to the roads.

Considerable space is devoted in this issue to the suit for infringement of patent, Westinghouse *v.* New York Air Brake Co. While at first sight, it may appear tedious reading, a more complete and luminous statement of the history and claims of the numerous patents involved has never been made public. The issues at stake are large, and while quick action brakes are well known and used throughout the civilized world, few are aware of the aspect of the brake question from a patent law standpoint. The matter will therefore be found to well repay perusal by those interested in this important question.

Rapid Transit in New York.

We suppose that the application of the Manhattan Elevated Company to the Rapid Transit Commissioners of New York is put out rather as tentative and as a suggestion to the Commissioners than as a complete and final plan. It will serve as a starting point for discussion, and is doubtless liable to modification. It will not be out of place therefore to give it a little consideration on that assumption. A map appears on another page with a schedule of the extensions and other privileges asked for. It will be seen that the plan provides for two complete three-track lines north and south on the west side above about the latitude of Eighth street, and that below that latitude there are three two-track lines down as far as Battery Place. From Eighth street up to Fifty-eighth there is a piece of two-track line, the existing Sixth avenue. We have then six tracks from Battery Place to the Harlem, and part of the way eight tracks. On the East side provision is made for two three-track lines from Chatham Square to the Harlem and for four tracks on the Bowery part of the Third avenue line. No additional facilities are asked for below Chatham Square. To sum up, then, we find six continuous tracks on both sides, instead of four, and some pieces of five, as now existing. But we do not find any sign of provision for increasing the capacity for handling trains at the southern terminus; therefore the changes proposed cannot increase the capacity of the system 50 per cent., although they do increase the tracks that much, speaking generally. But (and this is very important), the limit of capacity is now fixed by the southern terminals, and no provision is made to receive or dispatch more trains there.

It is obvious that the public convenience will be served by the changes and extensions. The very important west side ferry traffic especially will find the new line a great improvement. The west side residents far uptown will also have shorter walks. The several crosstown lines will be convenient for many persons, and the number of seats will be increased just so far as the number of trains dispatched can be increased, if they can be increased; but how about "rapid transit"? How far can the number of trains making fast time for considerable distances be increased? On the west side the number of trains received or dispatched must be limited, as we have said, by the capacity of the terminal, but we have no doubt that additional switching room will be provided either at the Battery terminus or at some point a little above, so that the number of trains handled can be increased. This is inevitable if the full benefit of the proposed extension is ever to be obtained. Up to Eleventh street the new West street line will provide for an important number of additional trains, but how many people will want to go to West street to take trains up in the evening, or how many will want to arrive there coming down in the morning? The important West street business, we should suppose, would be just the other way. Most of the people using that line will want to go uptown in the morning and down in the evening, at hours when the trains running in those directions on the old lines are not crowded. Still, it is probable that for the sake of getting express trains a good many people would walk from Greenwich street to West, and between those streets is a pretty busy district which must furnish a good deal of traffic for the elevated system. We may suppose then, that the West street line will have a certain influence on the express business and will relieve the congestion at the lower end of the west side system to an appreciable degree.

At any rate, all the trains must run slowly below about Fourteenth street, and make all the stops, so that the express service cannot begin until that latitude is reached. Then with the new lines and the additional track on the old Ninth avenue line, it will be possible to lower the running time a good deal, especially as the congestion at the intersection of Ninth avenue and Fifty-third street, where, as we said last week, 22 trains pass in the busiest 10 minutes of the day, and the delay due to the grade just above Fifty-third street will be relieved by the new loops. Consequently the time to and from the Harlem River may be considerably shortened by the proposed extensions.

On the east side the conditions at the lower end are essentially the same, or perhaps even worse, as the single line is longer. Everything below Chatham Square will remain as it is now, so far as the application of the Manhattan company has gone, but it is equally true that the capacity of the system to handle more trains below that point must be increased before the advantage of the six tracks above it can be had. On the face of it, the additional tracks on the Second avenue and Third avenue lines will enable the company to make better time after getting out of the crowded district, but there are several island stations on both of these lines which will prevent the middle tracks being continuous; and until these are made continuous, sustained high speeds cannot be made.

The plans now presented do not offer very much for the country above the Harlem. The extension of the Suburban Rapid Transit to Fordham is one good step, and of course better speed below the river will be a great convenience to the people living above; but we see no suggestion in the extensions proposed of a design to occupy that territory with lines running through trains to and from the Battery. The Fort George line for example is not likely to be ever extended much beyond the point indicated in the plan now submitted, for the reason that the terminus here shown is in the air, more than 200 ft. above the land immediately beyond it.

The further objection to the Manhattan's proposal has already been made that the company omits not only to provide for a continuous train service to the city limits, but that it omits also to promise a five-cent fare from the Battery to Yonkers and Woodlawn. We may set aside the business question of the profit or loss of carrying a passenger 15 miles for five cents, for that will ultimately have to be done by the company which undertakes to furnish rapid transit for the city. It will have to balance the profit of the short haul against the loss of the long haul, and this very fact may delay real rapid transit more than any other one fact. But it is hardly likely that the Manhattan is yet ready to submit a definite proposition for extension of its west side service above the Harlem. That it can do best by arrangement with existing railroads, and such arrangements are probably the subject of negotiation at this moment.

Summing up, the proposed extensions of lines and facilities seem very well calculated to serve the public but for two great defects. Nothing is said about the key of the whole situation, the southern terminals; and nothing is said about the extension of the system above the Harlem. Naturally the public wants to know the whole scheme, and the Commission must at least seem to want to know it.

English Railroads and Their Gathering-Grounds.

Generally English lines have their own distinctive areas of gathering-ground, which is more or less of a monopoly. Some monopolies, indeed, are of remarkable proportions for a small country like England. The North Eastern Railway Company, for example, has a virtual monopoly of the whole of the Northeast coast of England, including the important commercial and manufacturing towns of Stockton, Darlington, Newcastle, Middlesborough and Sunderland. Indeed, between the Ouse at York, and the Tweed at Berwick, the North Eastern system has a gathering-ground entirely its own, and one of so rich a character that the company has for many years paid dividends ranging from 6½ to 8 per cent. Other companies share their gathering-grounds with rivals, either by virtue of Parliamentary sanctions, which they cannot resist, or as a result of mutual arrangements, which are intended to operate to the advantage of both parties. Joint running powers, which are not unusual in England, give to more than one company the command of the same gathering-ground.

Notwithstanding the obvious value of such a record, it is probably correct to say that until quite lately, there has been no reliable index to the "territory" of British railroads. That index has now been supplied by Mr. R. Price Williams, a well known English railroad

	Area of gathering-grounds.			Miles of railroad open per 10 sq. miles of area.		
	1871. Sq. miles.	1891. Sq. miles.	Change. Per cent.	1871. Miles.	1891. Miles.	Increase. Per cent.
Great Eastern	5,634	5,482	— 2.70	1.46	2.01	37.67
Great Northern	3,220	3,389	+ 5.25	1.79	2.58	44.14
Great Western	12,019	11,954	— 0.54	1.45	2.09	46.15
London & Brighton	1,371	1,503	+ 9.39	2.51	2.93	16.73
London, Chatham & Dover	478	589	+ 23.22	3 08	3.19	3.57
London & North Western	6,174	7,018	+ 13.67	2.38	2.76	15.97
Lancashire & Yorkshire	1,295	1,206	— 6.87	3.30	4.32	30.91
London & South Western	3,989	4,868	+ 22.04	1.68	1.97	17.26
Manchester, Sheffield & Lincoln	1,444	1,450	+ 0.42	2.38	2.74	15.13
Midland	4,573	5,772	+ 26.22	2.20	2.63	29.54
North Eastern	6,908	6,842	— 0.95	1.90	2.39	25.79
South Eastern	1,548	1,448	— 6.46	2.11	2.74	29.86
North Staffordshire	701	644	— 8.13	2.64	3.11	17.80
Furness	617	548	— 11.18	1.61	2.69	67.08
Cambrian	1,564	1,506	— 3.70	1.14	1.81	58.77
Other lines	6,782	3,536	— 47.86	1.80	3.01	67.22
Totals and averages	58,320	57.755	.....	1.86	2.45	31.71

engineer, who has published through Messrs. Stanford, of Charing Cross, London, a capital map in which the tributary territory of the principal lines is clearly indicated. In this map are outlined with care the gathering-grounds of each of the principal companies that hold the field, showing where each company has gained or lost ground since the year 1871. The work, presents in a synoptical form the details of the development of the railroads of England and Wales during the last 20 years. As such it shows what companies have been most aggressive during that period, what companies have had their areas invaded, and what lines maintain the *status quo*.

The following table shows the areas of the gathering-grounds of the principal English railroad companies, in each of the years 1871 and 1891, with the percentage of increase or of decrease in each case. It also shows the number of miles of railroad open per ten square miles of area in each of the same years, and the percentage of increase in each case. It will be observed that the companies which have increased their areas of gathering-ground during the intervening 20 years have been the Great Northern, the London, Chatham & Dover, the London, Brighton & South Coast, the London & North Western, the London & South Western the Manchester, Sheffield & Lincolnshire, and the Midland, the last most of all. This list is of too mixed and unsymmetrical a character to justify any general argument as to the principles that control the increase of area. There could hardly be any two lines more unlike than the Midland, which serves a thickly populated mineral and manufacturing region, and the Chatham & Dover line, which serves a region that is almost wholly pastoral and agricultural, and yet it will be observed that these two lines lead in the increase of gathering area during the last 20 years.

The largest tributary area shown in the table for any one railroad is the 11,954 miles that fall to the share of the Great Western railroad, being about one-fifth of the total area of England and Wales. This, however, does not mean that the Great Western is the leading line, for the London & North Western, with an area of only 7,018 miles, has a larger capital, a larger traffic and a larger revenue. As regards the minor lines, whose areas have been reduced during the last 20 years or so, it is evident that they have been affected by the growing power and aggressiveness of some of the stronger lines, and that there is an increasing tendency to absorption and centralization on the part of the English system generally.

It was believed, more than 20 years ago, that the English railroad system had already reached a stage of development that was almost final, and that there was not much scope for further profitable extension. It is probable that these conclusions were both wrong. At any rate, the railroad system of England and Wales, during the period in question, has been increased by 3,047 miles, and the miles of railroad now open per 10 square miles of area are 2.45, as compared with 1.86 in 1871, showing an increase of 31.71 per cent. The following table shows the lines that have chiefly contributed to this advance of mileage :

Mileage of the Principal Railroads of England and Wales in 1871 and 1891.

	1871, miles.	1891, miles.	Inc. p. c.
Great Eastern	822	1,104	34.30
Great Northern	576	875	51.91
Great Western	1,718	2,499	45 46
London, Brighton & South Coast	345	439	27.25
Chatham & Dover	147	188	27.89
London & North Western	1,472	1,935	31.52
Lancashire & Yorkshire	428	5 3	22.20
London & South Western	669	958	43.20
Manchester, Sheffield & L	343	398	16.04
Midland	1,008	1,520	50.79
North Eastern	1,314	1,634	24.35
South Eastern	327	398	21.71
North Staffordshire	185	199	7.57
Farness	99	148	49.50
Cambrian	178	273	53.37
Other lines	1,219	1,061	—12.92
Totals and average	10,850	14,156	30.47

The principal increase of mileage shown in this table has taken place in the case of the Great Northern, the Midland and the Great Western among the big lines, and in the case of the Cambrian, the Furness and the South Western among the less important lines. The larger systems have not probably helped their revenue much by the extensions that have taken place in the last 20 years. Hardly any important main lines have been constructed during that period. The companies have mostly been engaged in opening up feeders to their already existing main lines in agricultural and sparsely populated districts, and with but few exceptions these feeders have not proved a lucrative investment. But the companies have not been slow to recognize the obligation resting upon them of opening up such traffic as was possible on areas not yet provided with railroad facilities, while it is also possible that they have had the spur applied to their action of threatened competition from another existing railroad and from a newly organized system, as in the case of the Hull & Barnsley line, which took to itself a large slice of the traffic that would otherwise have gone on the North Eastern system.

It is a notable fact that in spite of the enormous increase of traffic within recent years in the mineral and manufacturing districts, and of the economy in construction and maintenance rendered possible by the lower prices of material, both the capital expenditure per mile open and the percentage of working expenses, have shown a tendency to advance during recent years. The following tabular statement shows the receipts of the principal lines in 1891 under three separate heads :

Railroads.	Total receipts 1891. (£ = 1,000.)	Average receipts in 1891— Per mile of line open.	Per sq. mile of gathering ground.
Great Eastern	£3,931	£3,561	£717
Great Northern	4,378	5,004	1,291
Great Western	8,765	3,507	733
London& Brighton	2,453	4,887	1,427
Lon.,Chat.& Dover	1,280	6,506	2,173
Lon. & N. Western	11,824	6,108	1,685
Lan. & Yorkshire.	4,359	8.334	3,614
Lon. & S. Western	3,425	3,575	704
Manchester, Sheffield & Lincoln	2,462	6,185	1,698
Midland	9,501	6,557	1,646
North Eastern	7,024	4,299	1,027
South Eastern	2,069	5,199	1,429
N. Staffordshire	699	3,575	1,082
Furness	480	3.240	875
Cambrian	251	920	167
Other lines	3,882	3,648	1,098
Total and av'ges.	£66,672	£4,710	£1,154

It will be observed that the highest receipts per mile of line open, and the highest receipts per sq. mile of gathering ground alike belong to the Lancashire & Yorkshire system, which traverses the most important manufacturing district in England. The London, Chatham & Dover system has a larger gross revenue per mile of line and per mile of area than its next door neighbor on the list, the London & North Western, but the latter generally pays a dividend of six per cent. or over, and it is at the same time, perhaps, the best equipped and the best managed line in England, while the Chatham & Dover system is generally regarded as one of the poorest and worst. High average receipts, therefore, no matter what test they may be brought to, are not necessarily an evidence of prosperity or good management.

Comparative Coal Consumption per Ton Hauled in 1885 and 1891.

In view of the great increase in the weight of locomotives during the last few years, the accompanying table giving statistics of the fuel consumption on one of the leading railroad lines for 1885 and 1891 is particularly interesting. The class "E" and class "I" engines have respectively 6 and 8 driving wheels of 50-in. diameter, and weigh about 80,000 and 92,000 lbs. respectively. The class "O" engines are of the "American" type (8-wheelers) and weigh about 92,000 lbs. In addition to the changes in the locomotive equipment stated in the table, there has been a large number of heavy consolidation engines introduced between the years 1885 and 1891 on the divisions lettered A, B and D. It will be seen from the column headed "Average Tons per Train" that the weight of the trains has greatly increased, the increase in one case, Division D, being 144 tons. The coal used per freight car-mile has in general decreased, while the coal per engine-mile has increased, which would naturally be expected on account of the increased weight of the engines and trains.

The column of the table which most clearly shows the results of the changes which have been made during this period of six years is that headed "Pounds of Coal per Ton-Mile." The results in this column are in all cases less for 1891 than for 1885, and the greatest reduction is on those divisions where the heaviest class of engines is in use. The reduction in these cases is from 20 to nearly 40 per cent. As will be seen by the figures in the last column, the cost of coal per ton is in general higher for 1891 than for 1885, but in spite of this the cost of coal per ton-mile has been generally reduced, as shown by the preceding column. The column headed "Pounds of Coal per Ton-Mile" includes all the coal consumed by freight locomotives, together with its equivalent of wood, on the basis of one cord of wood being equal to one ton of coal. The column headed "Cost of Coal per Ton-Mile" includes the coal and wood consumed by freight locomotives, and the column "Cost of Coal per Ton" also includes the cost of wood used.

COMPARATIVE COAL CONSUMPTION IN 1885 AND 1891.

Division.	Year.	Number of locomotives in service.	Number of class E and I locomotives in service.	Number of class O locomotives in service.	Average tons per train.	Pounds of coal per car-mile.		Pounds of coal per engine-mile.		Pounds of coal per ton mile.	Cost of coal per ton mile. Cents.	Cost of coal per ton.
						Passenger.	Freight.	Passenger.	Freight.			
A	1885	128	64	..	196	10.16	5.53	61.19	104.05	0.54	0.034	1.24
	1891	144	17	22	243	10.79	5.16	64.29	105.06	0.44	0.028	1.27
B	1885	135	6	..	219	8.40	4.12	51.69	83.94	0.39	0.027	1.3
	1891	122	11	13	333	9.80	3.37	60.23	99 31	0.30	0.022	1.4
C	1885	47	10	..	249	13.13	4.39	44.05	81.37	0.33	0.021	1.25
	1891	75	41	..	275	13.43	4.72	48.51	79.49	0.29	0.017	1.18
D	1885	83	9	..	193	12.68	5.36	54.38	88.00	0.48	0.023	0.94
	1891	88	14	2	337	12.05	4.70	57.16	92.05	0.29	0.018	1.25
E	1885	12	..	..	163	15.00	4.24	45.93	72.32	0.46	0.040	1.75
	1891	18	8	..	192	13.61	5.34	48.30	85.62	0.45	0.045	1.98

Railroad Matters Before the Legislatures.

The principal railroad matters now before Congress are referred to in another column of this issue. In addition to the bills there mentioned, Representative Johnson, of Ohio, has introduced one on the subject of the controversy between the American and Canadian railroads over the enjoyment by the latter of alleged unfair facilities in this country. The bill requires Canadian roads to secure licenses to do business in the United States from the Interstate Commerce Commission and to file a bond agreeing to obey orders of the Commission and produce any evidence asked. The reporters in the various state legislatures continue to publish the usual quotes of railroad wisdom. In Alabama Mr. McCall proposes to have a state "Examiner of Trackmen," who is to see that section masters understand their business. He is to have a fee of $3 for each examination, Very likely this last is the most important clause in the bill, to those who propose it. Another bill prohibits the employment of operators under 18 years of age to handle train orders. The bill imposing upon locomotive runners a penalty for not keeping a constant lookout is still under discussion. In Colorado the People's party expects to reform things generally. A bill has been presented establishing a railroad commission of three men, each to furnish a $25,000 bond. An employers' liability law will probably be passed. The Colorado legislators are wrestling with a resolution forbidding members to receive passes from the railroads and mileage from the state at the same time. One member has had to spend two-thirds of his time returning passes sent to him by the railroads; he "would be burned at the stake rather than take one.' This state also wants to regulate sleeping car rates.

In Connecticut the law of 1889 forbidding members of the legislature to accept passes was considered by the House on Jan. 17, and a vote to repeal it was passed. In Indiana there is a bill to give railroad employés eight hours' rest after they have worked for 24 consecutive hours, providing that 10 hours shall constitute a day's work, and that any railroad employé who shall be required to perform extra service shall receive extra pay. The Minnesota legislature has before it a bill requiring locomotive engineers to have served three years as firemen, and another to tax sleeping cars, as recommended by the Railroad Commissioners; also one to change the Railroad Commission into a court, one to regulate grain warehouses and one prohibiting ticket brokerage. The latter is championed by the Order of Railway Conductors, who take this way of showing their friendliness to their employers. In Missouri a member of the lower House has introduced a bill to require separate passenger cars for colored passengers. A car with a partition will not be tolerated, except on roads less than 25 miles long. In Nebraska they propose to regulate sleeping car tariffs and will even forbid tips to porters. The bill does not state how this last feature will be enforced. The bill to compel the equipment of freight cars with air brakes in New York has been presented in the legislature; it requires 10 per cent. of the cars to be equipped yearly. In Ohio it is proposed to forbid railroad, street railroad or other corporations insuring themselves from damage for personal injuries caused by an accident. In the Pennsylvania legislature every third member has a bill under his arm and he hopes to get it passed. Most of the laws mentioned in the reports are, however, of only local interest, though

Mr. Tewkesberry proposes to reduce all passenger fares to two cents a mile. It is said that another attack on the railroad relief associations will soon show itself at Harrisburg.

In the senate of South Dakota a member moved that the Attorney General be instructed to prosecute the railroads for violating the provision of the constitution forbidding them to give passes for the purpose of bribes. This called forth "a great flood of eloquence."

The "Alley" elevated railroad in Chicago has been turned over to the Chicago & South Side Rapid Transit Railroad Company by the builders, the Rapid Transit & Bridge Construction Company. The contract was for an elevated structure of a given length, erected and equipped with rolling stock, and in operative condition. Dr. W. T. Barnard, General Manager of the Rapid Transit & Bridge Company, is President of the railroad company. The plan of operating the road and the method of dealing with the employés have been described at length in these columns, and are worth the investigation of any one interested in rapid transit matters. Some of the principal features are as follows: All promotions are made according to a fixed plan, based upon an examination of each individual employé and upon service record. Preference is given first to those who have the best examination and service records combined; second, to those who are married or who, not being married, have family responsibilities. Each employé is given a certificate which entitles him to three years' employment unless discharged for just cause, such as flagrant infringement of the book of rules. In all cases employés who are suspended pending dismissal, or who are dismissed, have the right of appeal to a board on which is a member of their own department. The rates of pay are better than for the same class of service on other roads and the hours are shorter. The pay is graded according to the length of service. This road is actively preparing for the World's Fair traffic; it will have block signals, interlocking switches and all modern safety appliances. It will be electric lighted from one end to the other; the current will be furnished from the company's own plant. The line is completed as far as Cottage Grove avenue on the east and is now opened to Sixty-first street. The yards at Sixty-first street are open and the headquarters of the engine and car men are at this point. The President is actively engaged in completing the facilities for handling the large traffic expected in April. All operating matters for present traffic are settled, and the road is working smoothly, but the present capacity of the line is hardly sufficient for the traffic night and morning, owing to the rapidly increasing popularity of the road. The residents along the proposed line of extension are urging the company to complete it immediately. The increased traffic to be gained by extension is considered more than sufficient to warrant the outlay; it will be built as soon as the World's Fair facilities are well in hand.

Transportation rates receive much attention, both in the farewell message of Governor Boyd of Nebraska and in the inaugural message of his successor, Governor Crounse. The law to regulate the railroads, passed two years ago, was vetoed by Governor Boyd on account of its unconstitutionality and its extremely defective construction. The existing Board of Transportation has evidently not satisfied the demands of the shippers, who are largely agricultural. The amendment, proposed in last fall's election, to make the railroad commission an elective body, was rejected by a two-thirds majority. Apparently there is a popular distrust of almost any plan of dealing with the question, which is not a wholly bad indication. It may mean that the insuperable difficulties in the way are seen, dimly at least, and the danger of ill considered action realized. The Board of Transportation, with Iowa's experience in mind, has never really tried to revise rates, though it is regarded as having full authority to do so. There is no telling what may happen at any time, however, for a proposition is now up to regulate by special statutes the rates on grain, live stock, coal, lumber "and like commodities in carload lots."

NEW PUBLICATIONS.

Master Car and Locomotive Painters' Association; Proceedings of Twenty-third Annual Convention.—The proceedings of this convention, which was held last September at Detroit, are now published in permanent form, and may be had through the Secretary, Mr. Robert McKeon, Kent, O.

Abstract of Arbitration Committee's Decisions.—Mr. J. D. McAlpine, a clerk in the shops of the Cleveland, Cincinnati, Chicago & St. Louis at Cleveland, has issued a pamphlet giving in brief form the substance of all the decisions made by the Arbitration Committee of the Master Car Builders' Association up to June, 1892, being Cases 1 to 123. The pamphlet puts the matter in a handy form for use by car inspectors, having no advertisements except on the cover. The advertisers, by the way, have sent free copies to heads of car departments. The body of the work is substantially an alphabetical index, with notes, to all of the decisions referred to. The condensation of the substance of the decisions seems to have been well done.

TRADE CATALOGUES.

Air Brake Parts.—The Crane Company of Chicago has issued a supplement to its railroad equipment catalogue. This supplement contains cuts and prices of the details of air brake apparatus which the company furnishes for repairs to the Westinghouse Air Brake Company's system.

Pig Iron Production for 1892.

Mr. Swank, General Manager American Iron & Steel Association, returns the total output of pig iron for last year at 9,157,000 gross tons; and right here we wish to congratulate him on the disappearance from his statistics of the net ton. He may possibly have been momentarily pained at strictures on its inconvenient employment, but we are certain that he feels as much pleased at its retirement as do those who have to refer to his valuable and complete reports. The production, by half years, was:

Year.	First half.	Second half.	Total
1888	3,020,092	3,469,646	6,489,738
1889	3,661,603	3,942,039	7,630,642
1890	4,560,513	4,642,190	9,202,703
1891	3,368,107	4,911,763	8,279,870
1892	4,769,683	4,387,317	9,157,000

The average production for the five years was 8,146,591 tons. This is some 24,000 tons more than the British average for the five years of their greatest production, commencing with 1880.

The product of 1892 is classified as follows, in gross tons:

	1st half.	2d half.	Total.
Anthracite	931,699	865,414	1,797,113
Charcoal	279,915	257,706	537,621
Bituminous	3,558,069	3,264,197	6,822,266
Total	4,769,683	4,387,317	9,157 000
Bessemer pig	2,254,345	2,189,696	4,444,041

Pig iron smelted with mixed anthracite and coke is included, as usual, under the head of anthracite. The production of spiegeleisen and ferromanganese, which is included in the above amounts, has been for the years mentioned.

1890.	1891.	1892.
133,180	127,766	179,131

The stocks of unsold pig iron were:

	Dec. 31, 1891.	Jan. 30, 1892.	Sept. 30, 1892.	Dec. 31, 1892.
Total	596,333	737,946	617,382	506,116
Anthracite	124,370	173,935	133,120	119,015
Charcoal	213,285	218,812	193,753	173,486
Bituminous	258,687	345,199	290,509	213,615

There were in addition to the above 29,500 tons, mostly Alabama iron, Storage Warrant Company, which had passed out of the control of makers.

Columbia River Railway Navigation Company.

This company was organized under its present title in 1890, and a portion of the heaviest work on the road was done in 1891. The work was fully described in the *Railroad Gazette* for May 8, 1891. Briefly, it is proposed to build a portage railroad along the north bank of the Columbia River around the obstructions to steamer navigation in the Columbia River at The Dalles, Or. The railroad will be about 22 miles long from Columbus, Wash., to Crates Point, and the building of this line will connect the navigable waters of the Upper Columbia and Snake rivers with those of the Lower Columbia. The contract to complete the line has been recently let by Paul F. Mohr, of Tacoma, Secretary and Manager of the company.

About six miles of the grading has been done, mostly rock work. The Columbia River, at The Dalles, lies in a deep canyon, the walls of which, composed of basaltic rock, rise in successive terraces of 200 and 300 ft. each to a height of 3,000 ft. The roadbed for a good part of the distance is blasted out of the rock.

The section of 22 miles now being built will be used as a portage railroad to convey the cargoes from steamers and barges on the Upper Columbia around the obstructions in the river, delivering them to vessels at the western terminus of the portage. Between Columbus (the eastern terminus of this portage road) and the heads of navigation on the Columbia and Snake rivers there are 540 miles of navigable water. Between the western terminus (Crates Point) and the mouth of the Columbia River there are about 290 miles of navigable water, including the Willamette River. The road may be extended, from time to time, eastwardly and westwardly to Walla Walla, Wash., and to Portland, Or., with a number of branches; and surveys have been made. The company will operate steamer lines on the Columbia River and its affluents to transport the cereals and other products from eastern Oregon and a portion of Idaho to the Pacific seaboard.

The contract for completing the 22 miles has been let to McKenzie & Glynn, of Spokane, Wash. Six miles of the 22, comprising the heaviest rock work, has been finished, but on account of heavy snows work has been suspended temporarily, but will be resumed as soon as the weather will permit. Three miles of track has been laid and the rails for the entire line have been purchased. The character of the work is exceedingly difficult, almost the entire line, as stated above, being in solid rock, as the line skirts the base of the basaltic cliffs or pallisades, flanking the Columbia River at these points. The maximum grades are less than 1 per cent., and the maximum curvature 9 deg. On the section now being completed there is one tunnel about 250 ft. long and one trestle about 800 ft. long and 80 ft. high, and a few small trestles.

The money thus far expended has been furnished by a construction syndicate which will furnish the money to complete the works. The first mortgage bonds of the company will not be offered for sale until this section of the road is completed. The amount expended to date is as follows:

For rights of way and lines	$64,272
Franchises and rights from other companies	67,276
Engineers' expenses	12,183
Construction	250,294
Rails and fastenings	101,191
Total	$495,216

The amount required to complete the 22 mile section to be used as a portage railroad is $315,000; the cost of river equipment consisting of steamers and barges will be $400,000; the cost of the line from Portland to Walla Walla will be $5,400,000, including the 22 miles now being completed; the cost of branches to be completed within three years about $1,800,000.

The officers of the company are: President, A. M. Cannon, Spokane, Wash.; Vice-President, J. Lowenberg, Portland, Or.; Secretary, Paul F. Mohr, Tacoma, Chief Engineer, Emery Oliver, The Dalles, Or. Mr. Mohr has an office at 45 Broadway, New York City.

Report of the Congressional Committee on the "Reading Combine."

The unanimous report of the Special Committee of the House which investigated the Reading anthracite coal combination was submitted to the House last week by Representative Coombs, of Brooklyn, N. Y. It recommends, as a means of protecting independent coal operators against discrimination on the part of the coal producing and transportation companies, that the Interstate Commerce law be amended to meet the effect of the Gresham and Counselman decisions, and that the long and short haul clause be made applicable to railroads which form connecting lines. The committee has come to the conclusion that the railroad companies engaged in mining and transporting coal are practically in a combination to control the output and to fix the price, but the evidence adduced seems to be rather vague. The fact is commented upon, that notwithstanding coal can be handled with less labor and transported with less cost and risk than almost any other class of freight, the freight charges, as tacitly agreed upon by all of the coal-carrying roads, are nearly double the rates for wheat or cotton. The committee concludes by saying that the public interest demands that the business of the common carrier should be absolutely divorced from any other business, and that some way of solving the problem must soon be devised by Congress and the states.

The New York *Evening Post*, commenting on this report, says:

The report reaches a lame and impotent conclusion. The proposed amendments to the Interstate law would not have any effect upon the situation as it now exists. The Committee's suggestions seem to have grown out of the practical failure of the Coxe suit against the Lehigh Valley road two years ago, and are framed to protect the individual coal operator against the unfair tactics of the coal carriers out of which that suit arose. But the Coxe case was not begun to save the consumer from higher prices, but to compel a fair division of the selling price between the coal carrier and the operator. The individual operator, for whose welfare the Committee is so solicitous, is to-day the most prosperous man in the anthracite trade.

The tidewater price is higher, he is getting a larger percentage of that higher price, and he is making money. By this arrangement the Reading managers have eliminated the individual operator from the problem of coal prices to consumers. That these individual operators (as distinct from corporate miners) must be protected so as to bring in competition is an unsound proposition, and to rely upon the efforts of these operators as a means of compelling lower prices to the public is really to give up the battle.

The committee are agreed that the acquisition of property by transportation companies not necessary to the business of a common carrier is "a growing and dangerous evil." But, as our anthracite is mined from a territory comprising less than 480 sq. m., it does not follow, because hard coal can be "cornered" by railroads, that other products—wheat, timber, iron ore—can be or will be. The situation as regards the anthracite fields is altogether *sui generis;* so that it is not easy to see what Congress can now do about the combination. The state of Pennsylvania is also handicapped by difficulties not always understood. The Constitution forbids the ownership of coal lands by railroads, but the present Constitution is but twenty years old, and the charter rights of the coal-carrying railroads antedate it. More than that, the citizens generally believe that higher wages to miners and greater prosperity to Pennsylvania operators and companies can be had by selling coal in other states at a better price than has been obtained till now; under this view it is doubtful whether public opinion there will sanction any real efforts to break up the combination. In brief . . . no outside interference with coal prices is likely to be effective; prices will probably be maintained at the highest level consistent with no large decrease in consumption. Strenuous efforts will be made to avoid dissensions and there are no signs of such. It is hard to see how low prices for domestic anthracite are to be realized in the near future.

Westinghouse vs. New York Air Brake.

This suit for infringement of patents for quick-acting air brakes, etc., is now being heard before Judge Thomson in the United States Circuit Court for the Southern District of New York. Messrs. J. Snowden Bell, Geo. H. Christy and Frederic H. Betts appear as counsel for the complainants, and Messrs. Maynadier and Brown for the defense. The evidence has all been taken, and the Westinghouse case was presented by Mr. Geo. H. Christy in an address which we give in a slightly condensed form below. He will be followed by counsel representing the New York Air Brake Co., and the Westinghouse case will be closed by Mr. Frederic H. Betts.

Mr. Geo. H. Christie commenced his address by explaining the gradual development of the Westinghouse brake from straight air to automatic and the reasons which, revealed at the Burlington trials of 1886 and 1887, led to

the invention of the Westinghouse quick acting brake, now so largely used, especially on freight trains.

In the "Westinghouse Quick-Action Patent of 1887, No. 360,070," the first and earliest, the triple valve piston has a double travel; the first part produced by a reduction of train pipe pressure of, say, six or eight pounds, should do the work of ordinary braking, as in making the usual stops at stations and crossings, as well as in controlling the speed of the train when running.

The further travel *could not* take place with the moderate reduction of air pressure above named, but *would* take place when, and only when, a materially greater reduction of pressure was effected of, say, from 15 to 20 lbs. This considerable reduction of train pipe pressure, effected by quickly shifting the engineer's valve on the locomotive, causes the piston of the triple valve of the first car of the train to move instantly through the entire length of its travel, and, in doing so, to impinge against or engage the vent or emergency valve of such triple, opening it and venting the train pipe pressure at that point into the brake cylinder. This new reduction of pressure in the train pipe *at that point* instantly operates the piston of the triple valve on the next car in like manner, and so on from car to car. And so rapid is this motion, or the transmittal of the effect from one triple to another, that in the Westinghouse apparatus the triples of 50 cars are operated in about two seconds.

The other way for operating the vent or "emergency" valve of the triple apparatus, as provided for by Mr. Westinghouse, is by the insertion into the triple mechanism of a separate piston, properly constructed for that work, and which piston shall be operated so as to open the vent or emergency valve, when, and only when, the "quick action" or "emergency" operation of the brakes is desired. In other words, instead of shifting the emergency valve by the ordinary piston of the triple mechanism, as in the previous form or embodiment of the invention, the work is now done by a piston specially constructed and provided for the purpose. And this added piston also has the characteristic that it is not shifted or moved in position so as to open the emergency valve, under those variations in train-pipe pressure which are incident to the working of the brakes for *ordinary* purposes. During such times it remains wholly inert. But, like the "further travel" of the main piston above referred to, it is brought into operation by, and only by, an extraordinary or excessive and *speedy* reduction of train-pipe pressure, say, of 12, 15 or 20 lbs. per sq. in. When this is done, auxiliary reservoir pressure instantly becomes efficiently operative on this piston of the emergency valve, with such force and in such direction as instantly to unseat such emergency valve, and thereby train-pipe pressure is vented into the brake cylinder in like manner as before, and with like effect as regards the succeeding triples of the following cars. So rapidly is the force transmitted from one triple to another that, practically, the application of the brakes is instantaneous throughout the fifty-car train.

This form of the invention is made more particularly the subject matter of the chiefest of the patents in suit —Patent No. 376,837, granted to George Westinghouse, Jr., Jan. 24, 1888.

On the drawing 63 represents the piston of the emergency valve, 41 is the emergency valve itself, and the vent port, through which the vented air passes to the brake cylinder, is represented at 16.

The method of operating the emergency valve by a piston specially constructed for the purpose, and operated by auxiliary reservoir pressure, has its advantages. Even small advantages are of the utmost importance where we are dealing with operations which, for their success, depend on very small fractional parts of a second.

In the apparatus of the Westinghouse 1887 Patent, No. 360,070, the emergency valve is a slide valve which has some friction, depending upon the size of the valve. As the venting action must necessarily be a *quick* action, a vent port of some size is employed. Hence, with an emergency slide valve of corresponding size, a correspondence resistance must be overcome, and in the 360,070 apparatus, the last travel of the piston must overcome that resistance.

In the Westinghouse 1888 Patent, No. 376,837, no such resistance is met with. The auxiliary reservoir pressure is applied suddenly, and with maximum power, directly to an emergency piston, specially constructed for the purpose, and so as to open a poppet valve, which does the required venting, and gives no frictional resistance.

Another, and perhaps a still greater advantage, relates to releasing the brakes. In the convenient handling of trains and especially of long freight trains, a brake which releases badly is almost as objectionable as a brake which goes on badly. Another advantage is less liabilty to the "sticking" of the brakes.

The evidence does not involve any serious dispute as to any material matter of fact. There is no pretense of any prior invention or use, by anybody or anywhere, of the invention now in dispute. Nor is there any question as to any matter of fact involved in the construction or operation of either the patented apparatus, or of defendants' apparatus. In fact, the testimony as taken, in so far as it goes to matters in dispute, is wholly of an expert character. Complainants have called and examined only four witnesses. Three of them, Mr. H. H. Westinghouse, the General Manager of the complainant company, Mr. H. B. Stone, formerly General Manager of the Chicago, Burlington & Quincy, and Mr. D. L. Barnes, a recognized authority in all matters of railway engineering, have been examined as practical experts on the practical questions which arise in the two cases. The other witness, Mr. Henry F. Newbury, of Brooklyn, N. Y., a skilled expert not unknown to the Court, has been examined with particular reference to the character and scope of the invention as patented, and as to the use of the same by the defendants.

In their first valve, defendants have infringed claims 1, 2, 3 and 6 of the Westinghouse Patent No. 376,837, of 1888.

(1) *The First "Quick-Action" Claim.*

The first of these claims reads as follows:

"1. In a brake mechanism, the combination of a chamber or casing having direct connections to a brake cylinder and to a brake pipe respectively, a valve controlling communications between said connections and a piston or diaphragm which is independent of and unconnected with a triple valve piston and is actuated by pressure from an auxiliary reservoir in direction to impart opening movement to said valve, substantially as set forth."

The first element of the combination which makes up this claim is recited as:

"A chamber or casing having direct connections to a brake cylinder and to a brake pipe respectively."

By this is meant the casing of the triple valve and quick action mechanism which is to have "direct connections to a brake cylinder and to a brake pipe respectively." Fig. 2 shows the "brake cylinder" connection at 16, and the "brake pipe" connection (by a branch from the main or train pipe) at 17.

"A valve controlling communication between said connections" (41) covers a port directly in the line of communication from the train pipe connection 17, at the extreme right, to the brake cylinder connection 16 at the top."

The third element of the combination is:

"A piston or diaphragm which is independent of and unconnected with a triple valve piston, and is actuated by pressure from an auxiliary reservoir in direction to impart opening movement to said valve."

The emergency valve piston 63 fulfills all the three conditions specified.

1st. It is "independent of and unconnected with a triple valve piston" (12), as there is no mechanical connection between these two devices, the emergency valve piston (63) and the triple valve piston (12).

It is also required that the piston 63 must be "actuated by pressure from an auxiliary reservoir in direction to impart opening movement to said valve."

This is the sole function which, according to the claim, the piston 63 must possess. That is to say, it must,

2d. Be "actuated by pressure from an auxiliary reservoir," and such pressure must be in a specified direction; that is,

3d. "In direction to impart opening movement to said valve."

"Said valve" means the valve 41 above referred to.

During the ordinary working of the train brakes the quick action or emergency piston 63 is wholly inert. It is balanced perfectly by atmospheric pressure on each side, and performs no function or duty whatever; but when the emergency arises, it is needed badly.

It is worked "by pressure from an auxiliary reservoir,"—which as illustrated in the patent, passes through a port 61, when the latter, on an extreme reduction of train-pipe pressure, is uncovered for the purpose. "Pressure from an auxiliary reservoir" then becomes operative on the left hand or upper side of piston 63 so as to force it to the right or downwardly, and pushing on valve stem 64 it unseats the valve 41. Train-pipe pressure then acting through the connection 17 raises the check valve 49 (which gives but little resistance, being held lightly to its seat by a spring 50), and train-pipe air is then vented freely through the connection 17 and out at port 16 to the brake cylinder, with the result of hastening or expediting a like action in the triple valve, and also of operating the vent or emergency valve of the next car, and thereby increasing the rapidity and force with which the brakes are applied.

In this way the only remaining requirement of the claim is fulfilled; that is, the piston "is actuated . . . in direction to impart opening movement to said valve."

Is the invention of this claim found in the defendant's apparatus?

Plate V., of the New York Air Brake Company's catalogue, "Quick Action Triple Valve," shows the device which they first used has a "chamber or casing" suitable for inclosing, protecting, and properly guiding, a triple valve mechanism, and a quick action or emergency vent mechanism. This "chamber or casing" has "direct connection to a brake cylinder," and "direct connection to a brake pipe," thus containing the first element of the Westinghouse first claim.

At 20 will be found "a valve controlling communication between said connections,"—that is, between the "train pipe" connection at the lower left hand corner and the "brake cylinder" connection on the right hand side.

This gives the next element of the Westinghouse patented combination.

The party who designed defendants' quick action valve evidently thought, by the changes which he introduced, to avoid liability for infringement. He has taken the piston 63 of the Westinghouse patent out of its direct relationship to the emergency valve, and made it do the same work by the same motion and by the same pressure, but in a roundabout way.

The piston 63 of the Westinghouse patent is reproduced in construction and in function, in defendants' apparatus, in the piston 13. The claim says that it must be "independent of and unconnected with a (the) triple valve piston." This feature is true of defendants' piston 13. It is "independent of and unconnected with" the triple valve piston 2.

The claim says that the piston in question must be, (1) "Actuated by pressure from an auxiliary reservoir." (2) "In direction to impart opening movement to said valve,"—meaning thereby the vent valve. The piston 13 of defendants' apparatus fulfills perfectly both of these requirements. It "is actuated by pressure from an auxiliary reservoir," which pressure is always present in the chamber or space marked *G* at its upper end, so as to be in readiness to act whenever an equal pressure on its under side is relieved or sufficiently lessened. When the piston 13 is so "actuated" by such pressure, it is moved downwardly or "in direction to impart opening movement" to the vent or emergency valve 20.

Train-pipe pressure and auxiliary reservoir pressure, though known by different names, are, ordinarily, the same in amount. That is to say, when the train is in running order, with train-pipe pressure of, say, 70 lbs. per square inch, the same pressure of 70 lbs. per square inch will be present in each auxiliary reservoir. Ordinarily the port through or past the triple valve piston is the dividing point between these two pressures. On the charging or train-pipe side of the triple piston this pressure is known as "train-pipe pressure." On the other, or auxiliary reservoir side of the triple piston, it is termed "auxilliary reservoir pressure." As already stated, when the train is running, or is in running order, these two pressures are practically the same in amount. And this is confessedly true of defendants' apparatus as well as of complainants'.

Hence, in the defendants' quick action triple, Plate V., when the train is in running order, we will have the 70 lbs. of supposed pressure both in the train pipe and in the chamber or space immediately below the piston 13, where it is called "train-pipe pressure," and we will have a like amount or degree of pressure in the auxiliary reservoir, and also in the chamber or space *G*, immediately above the piston 13; and here it is called, and universally known as "auxiliary reservoir pressure." As to these facts, there is and can be no dispute.

With defendants' apparatus, when the engineer desires to work the "quick action" or "emergency" feature, he does it in identically the same way as provided by Westinghouse, by a quick and considerable decrease or lessening of train-pipe pressure, which is effected by the proper shifting of the engineer's valve. This reduces the pressure on the left hand side or end of the defendants' triple valve piston 2, so that, as a result of back pressure from the auxiliary reservoir, such piston will at once make a length of travel sufficient to close the port or opening *F* near its lower edge. The auxiliary reservoir and train-pipe pressures will then be entirely separated from each other and the pressure in the space or chamber *G* will be "auxiliary reservoir pressure."

The piston 13, by the preponderance of auxiliary reservoir pressure from above, is pushed downwardly, or, in the exact words of the claim, is "actuated by pressure from an auxiliary reservoir." This downward motion, or stroke of the piston 13, instead of acting directly on the emergency valve 20, acts *indirectly* on that valve, but so as to make it do the same work. The piston 13, by its downward movement, depresses or unseats a valve 14, and thus opens a port or passageway *K*, which leads to the upper side of another piston marked 17, so that train-pipe pressure, which still exists below the valve 14, of, as supposed, 50 lbs. to the square inch, passes instantly through the port *K*, and becoming operative on top of the piston 17, forces the latter downward so as to unseat the valve 20. In effect, the downward stroke of the piston 13, by an interposed column of compressed air and an interposed additional piston, in the exact words of the claim, "imparts opening movement to said valve,"—which now is the valve 20.

Since piston 13 and piston 17 of the defendants' device are so connected that the movement of the former necessarily results in the downward movement of the latter, so as "to impart opening movement" to the valve 20, which is the thing to be moved, then mechanically, the two pistons are to be considered as a single piston. One moves the other as certainly as if they were rigidly connected.

Cutting a piston into two parts, and so uniting them that one part necessarily moves the other, does not destroy its mechanical identity as a piston. This is not a new question in patent law. In the case of *Klein* vs. *Kloman, Park & Company*, 13 Pat. Off. Gaz., 5, decided by his Honor Circuit Judge McKennan in 1877, almost identically the same question arose.

The late Judge Woodruff, in *Wheeler* vs. *Clipper Mower and Reaper Company*, 6 Fisher's Pat. Cases, 1, ruled: "A patent for a device cannot be avoided by dividing it into two parts, which, when combined, produce the same result in substantially the same way."

Justice Hunt in *Blake* vs. *Robertson* ruled:

"Whether the force is applied to the jaw by its contact with a wooden beam, with an iron rod, or with a column of water, is unimportant, in principle. These are mechanical equivalents, and a patentee cannot be deprived of the benefit of his invention by the substitution of one in the place of another. In the Smith machine, the column of confined water produces the same result as the iron rod in the Blake machine."

If defendants' pistons 13 and 17 were connected by suitable mechanical devices, such as the Court above specify as constituting part of the Blake machine, so that when the piston 13 moved downwardly it also moved the piston 17 downwardly, and thereby imparted opening movement to the vent valve 20, the two pistons would then be mechanically the same as a single piston. And if this be so, then the ruling of the Supreme Court above cited is directly in point to the effect that a fluid pressure column interposed between the two, and so connecting them that the motion of one is transmitted to the other, designedly, necessarily and inevitably, then such fluid pressure column is the mechanical equivalent of such supposed mechanical connection.

Mr. Metcalf, defendants' first expert, states defendants' first theory of the defense, as follows:

"The emergency valve piston in Patent 376,837 (Westinghouse) is dependent for its operation upon the extreme movement of the triple valve piston."

"The emergency valve piston of defendants' quick action triple valve operates wholly independently of the triple valve piston."

"This is the main and essential difference between the two devices, and all the differences of detail, such as the relative arrangement of ports and passages, are subordinate and comparatively unimportant."

This position of Mr. Metcalf's involves at the outset a misconstruction of the claim, as well as a misstatement of the invention. The Westinghouse first claim says that the emergency valve piston is "*independent*" of the triple valve piston. Mr. Metcalf says that it is "*dependent*."

Mr. Metcalf next endeavors to incorporate into the Westinghouse first claim, by implication, three elements which are not named at all therein, the triple valve, the triple piston, and the stem which connects such piston with that valve.

In the Westinghouse patent a hole, opening or port is provided through which auxiliary reservoir pressure may pass to the emergency piston whenever the quick action of the brakes is desired.

The triple piston and piston and its stem merely move the valve which opens and closes the port to let on the auxiliary reservoir pressure to the piston 63, when the quick action of the brakes is desired, and to shut it off at all other times.

None of these three added elements is mentioned in any way in the Westinghouse first claim, nor are they essential to the work which the combination of that claim is organized to perform.

So far as relates to the emergency piston, the only functions performed by the triple slide valve are:

(1.) When the quick action operation of the brakes is desired, the triple slide valve uncovers the port, so that auxiliary reservoir pressure may then flow through such port, and, pressing against the emergency piston, may impart opening movement to the emergency valve.

When the supply port is open between the auxiliary reservoir and the emergency piston, defendants' apparatus is substantially identical with claimants', both in fact and under the terms of the first Westinghouse claim.

(2.) When the quick action operation is *not* desired, the triple slide valve of the Westinghouse patent closes the port, and thereby *shuts off* auxiliary reservoir pressure from the emergency piston.

In the Westinghouse valve the quick action piston is not subjected to pressure from the auxiliary reservoir during such time as its action is not required. In the defendants' device, the piston is *always* subject to auxiliary reservoir pressure on one side, counterbalanced by an equal pressure on the other side, and so that by lessening the latter pressure the former or auxiliary reservoir pressure becomes efficiently operative, only when the quick-action operation is desired.

This difference is wholly immaterial as regards any work which the quick-action piston has to do. It is not referred to in the claim, either expressly or by implication. It is only in exceptional cases that the courts read into claims elements not mentioned therein; nor are claims limited by features not referred to at all therein and not of the essence of the invention.

The law on this subject is clearly and fully stated in

Lake Shore & M. S. Company vs. *National Car-Brake Shoe Company*, 110 U. S. 229.

The Supreme Court ruled: "There is no suggestion that the combination of the second claim was not new."

No more is there in the present case.

"There being nothing shown in the state of the art which receives any such construction of the second claim as that contended for by the defendants."

The same is true in the present case, word for word, as regards the Westinghouse first claim.

The third condition specified by the Court:

"And it being fairly susceptible of the opposite construction," is true of the Westinghouse first claim, but it is also true that such "opposite construction."—contended for by complainants, is actually required by its terms.

A fourth proviso specified by the Court:

"And the latter (i. e., complainants' construction) being one which is commensurate with the real invention embraced in the second claim," is true of the present case and the Westinghouse invention is broader than the broadest possible construction of the claim. The claim, broadly construed, is no more than "commensurate with the real invention."

The last requirement specified by the Court in favor of the broad construction of the claim is that such construction is "One which prevents the real substance of that invention from being bodily appropriated by an infringer."

And this, too, is applicable in the present case. In such case, that is, where these requirements coincide, the concluding phrase of the above citation would seem to be applicable that "it is proper to give the claim such a construction," that is, the broad construction contended for by the patentee.

The above decision is exactly in line with the adjudications of the U. S. Supreme Court whenever the same or a similar question has arisen. Thus, nearly forty years ago, in *Winans* vs. *Denmead*, the Court say:

"It is generally true, when a patentee describes a machine and then claims it as described, that he is understood to intend to claim, and does by law actually cover, not only the precise forms he has described, but all other forms which embody his invention; it being a familiar rule that, to copy the principle or mode of operation described, is an infringement, although such copy should be totally unlike the original in form or proportions."

Other statements of the same rule may be cited almost without number. The views of the U. S. Supreme Court may be made reasonbly clear by two citations. The first is from *Winans* vs. *Denmead*, 15 How. 330, 341.

"Now, while it is undoubtedly true that the patentee may so restrict his claim as to cover less than what he invented, or may limit it to one particular form of machine, excluding all other forms, though they also embody his invention, yet such an interpretation should not be put upon his claim if it can fairly be construed otherwise, and this for two reasons:

1. Because the reasonable presumption is, that, having a just right to cover and protect his whole invention, he intended to do so. *Haworth* vs. *Hardcastle*, Web. P. C. 484.

2. Because specifications are to be construed liberally, in accordance with the design of the constitution and the Patent laws of the United States, to promote the progress of the useful arts, and allow inventors to retain to their own use, not any thing which is matter of common right, but what they themselves have created."

The cases are multitudinous in which a part or the whole of the defense consists in an effort to limit the scope of the claim, by reading into it some modifying or additional element which is not named therein, and which is not an essential feature of the invention as actually made.

2. But defendants' contention on the issue of infringement is not only unfounded in law, but it is without merit or substance in fact.

It has already been stated that normally the quick action attachment is not used. In the ordinary running of trains, or in making usual service stops, it is to be used only in the presence of danger. In the entire absence of danger it does not make the least difference whether the emergency piston of the Westinghouse patent or the similar piston of the defendants' apparatus has a ton of force acting on one side and counteracted by another ton acting on the other side so as to keep it at rest, and thereby *preventing it from* acting at all; or whether such piston in either case is subject to auxiliary reservoir pressure, or to no pressure at all on its opposite sides. It is equally inert until, by an extraordinary and quick reduction of train-pipe pressure—say of 20 lbs. per sq. in.—the quick action or emergency feature is called into operation. Then, and not till then, the question of pressure becomes a material one; and when we get to that time in the operation of the apparatus, we find that we have auxiliary reservoir pressure equally operative on both pistons, and brought into operation in the same way, for the purpose of producing the same effect—the opening of the emergency valve. Hence in the co-operative action of the devices in the first claim, we have the same device, a piston, brought into operation in the same way, by the lowering of train-pipe pressure, so as, by the same force, auxiliary reservoir pressure, to be actuated in the proper direction for doing the same work, opening the emergency valve, and all this finally results in identically the same operation and effect, the automatic venting of one triple valve in such way as to hasten a like action in the next triple.

While the defendants' triple piston does not need the "further travel," in the Westinghouse triple, defendants' piston *must* make *enough* travel to put the brakes into normal operation, before the quick action or emergency operation can take place. If defendants' triple piston fails to operate the exhaust port leading to the open air would not be closed, and, consequently, any pressure which might be vented through the port leading to the brake cylinder would escape to the open air. This appears from witnesses on both sides.

It necessarily follows that in defendants' device a movement of the triple piston is as essential to the quick action or emergency operation as is the case in the Westinghouse mechanism. Such operation cannot take place in either system, unless there has been a preceding movement or travel, greater or less in extent, of the triple valve piston. As a matter of practical operation this latter device is as important in one as in the other. In this sense it does the same work in both. And in both, it is brought into action in identically the same way, by reduction of pressure in the train pipe.

Hence, it would seem to be clear that the mere manner in which an opening movement is transmitted to the emergency valve from the operating piston, is not of the essence of the invention. The only essential things are that when the piston is to be operated, reservoir pressure shall actuate it; next, that when actuated, such actuation, or the movement resulting therefrom, shall be "in direction," upwardly, downwardly, sideways, or by a reciprocating, rotary, or zigzag or some other motion, "to impart opening movement" to the emergency valve. If the piston moves, or, as the claim states it, is "actuated by pressure from an auxiliary reservoir," and, as a result of its motion, exercises a force "in direction to impart opening movement" to the emergency valve, then all the essentials of the invention of this claim are clearly present, without regard to the particular form of construction of the intermediate mechanism by which it is effected.

On a somewhat similar question, the late Judge Woodruff, in *Waterbury Brass Company* vs. *Miller*, 5th Fisher 48, 65, 66, expresses his views as follows:

"It was thenceforth in no wise essential to any principle involved in the invention by what means motion was communicated to the machine or either of the parts. It was only necessary to the successful operation of the machine, and to the certain production of the desired result, that the parts of the machine should move at the same time."

In like manner in the present case, auxiliary reservoir power adequate to move the emergency piston, and open the emergency valve, is all that is necessary. Nothing else is essential either for the invention as actually made, or under the terms of the claim.

The argument that the triple slide valve 14 is essential to the combination of claim 1, for the reason that if it was not present, the emergency valve would be always open, is utterly fallacious. Of course if the triple slide valve 14 were taken away and *if nothing else* were provided by which to control the pressure which, at the desired time, puts the emergency piston in motion, then, obviously, the apparatus would not do the work required. But the assumption thus made, which is that *nothing else* is put in its place, contains the fallacy in the argument. The pressure which does the work must be controlled in the defendants' quick-action valve as in the complainants'. In the latter apparatus the triple slide valve, in its relation to the emergency piston, simply controls the pressure which operates the piston. The defendants, in dispensing with this element of control, merely substituted another of like character, which does the same work. As already stated, the actuating of the emergency piston so as to impart opening movement to the emergency valve, and the doing of it by means of auxiliary reservoir pressure, is simply and only a question of pressure on the emergency piston. If, when its action is not desired, all pressure is cut off on one side, there should be an absence of pressure on the other side. This is the construction illustrated in the Westinghouse patent. If, on the other hand, during the time when the action of the emergency valve is not desired, the emergency piston is under pressure on one side, then obviously, during such time, such pressure must be counterbalanced. This is exactly what defendants' do. Then, when the emergency operation is desired, such counterbalance is destroyed, auxiliary reservoir pressure becomes efficiently operative, and the work is done in defendants' apparatus, identically as in complainants'.

It does not seem to be seriously denied that the defendants' apparatus comes fully within the terms of the Westinghouse first claim. Mr. Carpenter, one of defendant's experts, actually admits it.

Hence, it is submitted that thus far in their denial of infringement, the defendants have utterly failed to disprove the charge.

"Further theories of the defense" amount to this: that the novelty in the Westinghouse patent consists in controlling the emergency piston by means of the main valve of the triple. The insufficiency of this as a defense has already been discussed. But defendants further say that this feature or element is *the thing* which is found in this Westinghouse patent, and which is *not found* in the previous Westinghouse quick action Patent No. 360,070, and is a thing which is not found in their device. Hence, they say they do not infringe.

I have defended many patent suits and I could have made a perfect defense in every case if I had been authorized to define the patented invention *in my own words* excepting in those rare cases where the patented thing is duplicated both in form and in substance.

Defendants define the invention to suit themselves, and then they say that they do not use the thing which they have thus defined. But in making their definition defendants have practically ignored the patent itself.

The first claim of the patent says not a word of any control of the emergency piston by means of the main valve 14 of the triple. The claim says as to the element of novelty:

The emergency piston,—must be "actuated,"—not by the main valve of the triple, as contended for by defendants—but "*by pressure from an auxiliary reservoir.*"

That was new to Mr. Westinghouse. *That* is *not found* in the previous quick action Westinghouse Patent No. 360,070, and *is found* in the defendants' device. Defendants simply made an erroneous and misleading definition of the invention in question: and in order to make it they had to go outside of the claim which states it directly.

Mr. Massey states that the Westinghouse quick action patent of 1887, No. 360,070 was a failure in the Burlington trials. This is immaterial to the present case, since that patent is not now in suit.

It abundantly appears that to Mr. Westinghouse is due the invention of what is known in this case as the quick action brake. Such a thing was previously unthought of by anybody anywhere. And it is a *great* invention. The quick action brake is a new additional brake which possesses the rare merit that, though always present, it does not interfere in any respect with the operation of the old brake.

Mr. Westinghouse being thus a pioneer in this field of invention, all his claims are entitled to the broadest possible construction, whether in Patent 360,070 or in 376,837. Both relate to different parts of the same invention. The feature of novelty particularly summed up in the first claim of the Patent now in suit is as original and valuable as any feature of novelty in the entire apparatus.

On this point the rulings of the Supreme Court are numerous and controlling. Thus, in *Railway Company* vs. *Sayles*, 97 U. S. 554, 556, the Court ruled:

"Like almost all other inventions, that of double brakes came when, in the progress of mechanical improvement, it was needed; and being sought by many minds, it is not wonderful that it was developed in different and independent forms, all original, and yet all bearing a somewhat general resemblance to each other. In such cases, if one inventor precedes all the rest, and strikes out something which includes and underlies all that they produce, he acquires a monopoly, and subjects them to tribute."

Defendants also try to make it appear that the words used in the first Westinghouse claim when describing the emergency piston, that it "is independent of, and unconnected with a triple valve piston," are incorrect.

But such is not the correct rule of law, and never was. The words referred to have a meaning which, in view of the context and of the invention itself, is frequently given to such words and will not be rejected, where the purpose of the rejection is merely the adoption of an unintended and impossible meaning.

In the Westinghouse quick action patent No. 360,070, of 1887, when the emergency operation was desired, the stem of the triple piston was caused to impinge directly against or mechanically engage the stem of the emergency valve. These two stems were arranged exactly in line with each other, end to end, so that one came endwise against or struck the other, pushed it along, and so opened the emergency valve.

Consequently there was here a *dependence* of one of these two devices on the other, in the strictest sense of the term. When the claims of the Westinghouse 1888 patent now in suit, No. 376,837, were prepared, the "*dependent*" action had been omitted or dropped out. It was no longer the triple piston which "actuated" the emergency piston, but "*pressure from an auxiliary reservoir.*"

Consequently, to make clear this distinction between these two patents, it was stated in the claim of the later or 1888 patent that the emergency valve in the latter patent, instead of having the triple valve piston strike against it and push it off its seat, is really "*independent of and unconnected with* a (such) *triple valve piston*," and also that, instead of being thus pushed along by the stem of the triple valve piston, it is "*actuated by pressure from an auxiliary reservoir.*"

(1.) The distinction thus drawn is true.

(2.) The language employed in the first claim sets forth or states the distinction or difference with the utmost clearness.

(3.) The claim is not open to any charge of inaccuracy or incorrectness.

And still further, even if defendants' criticism were true, that the words referred to were used incorrectly, defendants have failed to show that either they or any one else have ever been at all misled thereby.

Hence, as to the first Westinghouse claim, it is submitted, not only that a clear case of infringement has been made out, but also that every matter of defense set up in reply thereto is without any substantial equity.

The second claim of the Westinghouse patent now in question simply adds, to the combination of the first claim, the further element of:

"A check or non-return valve controlling communication between the emergency valve and the brake pipe passage of the chamber."

The function of this check valve is simply to prevent the reverse or back flow of air from the brake cylinder through the port.

The importance of this check valve in the combination will readily appear from a brief explanation.

Partly on account of the difference in the relative areas of the port openings, which is necessary for other purposes, compressed air from the train pipe will be vented into the brake cylinder through the port in advance of any considerable flow of air from the auxiliary reservoir into such cylinder. As the compressed air in the brake cylinder is wanted there for the work of applying the brakes, it is important that none of it should pass back. To prevent this, a check valve is provided at that point where it will best do its work, between the emergency valve and the source of supply.

The check valve of defendants' first construction of apparatus is not only of the same construction, but arranged at the same point between the emergency valve and the source of supply, and being so arranged it will do identically the same work in identically the same way. Hence infringement is not denied.

The third claim of the Westinghouse patent is as follows:

"3. In a brake mechanism, the combination, with a triple valve, of a supplemental chamber or casing having passages leading to a brake cylinder and to a brake pipe, respectively, a supplemental valve controlling communication between said passages, a supplemental piston operating independently of the triple valve piston and adapted to impart opening movement to said supplemental valve, and a passage establishing communication between said supplemental piston and an auxiliary reservoir, substantially as set forth."

As defendants' apparatus contains "a triple valve," infringement is evident.

The emergency valve chamber is "supplemental," or is added to the chamber of the triple valve proper. This also appears in the defendants' structure.

The emergency valve of the first claim is, in the third claim, called "a supplement valve," but this is only a difference in names. The functions are the same, so that *the same thing* is referred to, which is supplemental to the "triple valve."

The final element of the third claim is "a passage establishing communication between said supplemental piston and an auxiliary reservoir." The passage referred to includes the entire triple valve chamber and also the port marked 61. The former is always open to auxiliary reservoir pressure, and the latter is opened at such times as the auxiliary reservoir pressure is desired for operating the emergency piston. In the defendants' apparatus the corresponding passage consists of the chamber *G* and the port leading into it from above. This chamber, with its communicating port, being always open, fulfills all the requirements of the claim as well as of the invention, in that it is open when the auxiliary reservoir pressure is to be applied or used in opening the emergency valve. Hence the infringement is clear.

There is no denial of infringement except against the first claim. The insufficiency of such a defense has already been presented.

The sixth Westinghouse claim relates to a detail of mechanical construction. The ordinary way of adding one mechanical device to another, where each has a casing or shell of its own, would be simply to make their abutting sides open, provide suitable intermediate packing and connections to the ports, and bolt them together. Had Westinghouse done this, the contention of defendants that such a connection involved only the ordinary skill of a mechanic would be well founded. But he *built onto* a portion of the shell of the triple valve, the emergency mechanism casting them in one, making the division through the quick action shell at a point or facilitate construction and enable the emergency piston to be got into its place back of the guides through which plays the stem. This could not be done if that plane of division were elsewhere.

The sixth claim reads as follows:

"6. In a brake mechanism the combination of a triple valve casing a supplemental valve chamber composed of an inner section which is formed integral with the triple valve casing and a separable outer section, each

having a lateral air pipe or passage and a supplemental valve seat formed in a division plate or partition interposed between and secured to the two sections of the supplemental valve chamber, substantially as set forth."

The meaning of this claim in relation to the drawing will be readily understood. The triple valve casing must have "an inner section" or, as above explained, a portion of the "supplemental valve chamber . . . formed integral" with it, and "a separable outer section" or another portion as above explained, to be secured thereto, each of these casings having the other features specified in the claim, and such as are essential to the invention.

The defendants cannot deny patentable invention here, because they use identically the same device. The shell in which both the pistons 13 and 17 are arranged is made integral with the casing of the triple valve proper. The remainder of the emergency valve casing is made in a separate piece and bolted on. The fact that they have copied it so accurately shows that the difficulty encountered in making these casings could not well be overcome in any other way and that more than mechanical skill was required when Westinghouse overcame the difficulty in the manner claimed.

This plane of division involves a mechanical interposition of a valve seat at a suitable point in the structure with reference to the proper seating of the emergency valve where it can be made to do its proper work, and be worked by the emergency piston. The device thus introduced at the junction point of the two sections, in the Westinghouse patent is marked 65, and in the defendants' device 18. This plane of division involves the proper arrangement and alignment of the ports through which the train-pipe pressure in the "separable section" is made to reach and pass out at the brake cylinder port which has to be made on the other section.

Patentable invention consists in the adaptation of means to an end, the means being new and the end useful, and Westinghouse, in dividing the quick-action or emergency shell, making one part of it integral with the shell of the triple valve proper, and by the insertion of the valve seat at the plane of junction and with the emergency piston and its guides, together with the brake cylinder connection in the "inner section" and the residue of the co-operating apparatus in the "separable section," has clearly brought himself within the reasonable limits of the rule. And the defendants, by their Chinese copy, are not entitled to any favorable construction of the rule.

Defendants' expert, Metcalf, endeavors to make out an anticipation of the subject matter of the sixth claim, by reference to a patent of his own inventor, Massey, No. 358,867, and also to three patents of Westinghouse. He, however, misunderstands the invention in question, saying:

"The construction referred to in this claim is nothing more than clamping a ported diaphragm between two sections of a valve chamber, and is not invention, but only familiar construction."

Mr. Metcalf has overlooked a well defined distinction. There is a clear mechanical difference between two chambers and one chamber.

The sixth claim involves the making of one sectional part of such chamber *integral* with the main casing of the triple valve—and that, too, without destroying its integrity as a part of the new chamber to be made. This was wholly overlooked by Metcalf. Also, the unitary operation of the emergency piston and valve of the sixth claim, with reference to which the ported diaphragm is arranged, gives this single chamber a mechanical character which differentiates it from anything in the Massey patent.

The difference between the sixth claim and the three Westinghouse patents cited by Metcalf are more obvious.

Hence, all the claims referred to are valid, and as each is clearly reproduced, and therefore infringed in defendants' Plate V., defendants brought out in February last a new or "modified" quick action triple valve, the one discussed thus far on account of some mechanical defect in practical operation or for some commercial reason, having failed to meet public acceptance. We have now to consider this new valve.

Comparing it with Plate V.,the more noticeable changes will be readily seen. Instead of two pistons, 13 and 17, as in Plate V., we now have but *one* piston in the emergency attachment, and this piston the defendants have with a wise mathematical accuracy marked "13,"—and this, too, in view of the fact that it occupies the position which in Plate V., belongs to the piston there marked 17. The chamber *G* is still found, and it is also in communication with the piston which is thus marked 13. Of course the valve 14 with its underlying spring 16, as also the port *K*, being no longer necessary for connecting two pistons together, are wholly omitted in the new valve.

The significant fact is this: Auxiliary reservoir pressure operates directly on the emergency piston which does the work of imparting an opening movement to the emergency valve, and does this work directly, instead of indirectly as before, and thereby vents the train-pipe pressure directly into the brake cylinder. It operates on identically the same piston described and shown in the Westinghouse patent for doing such work, operates in identically the same way, so as to move such valve in identically the same direction, and thereby to impart identically the same opening movement to identically the same emergency valve, for performing the same identical function in identically the same way. The position and arrangement of such emergency piston 13, together with all the mechanisms operating in connection therewith, are identically the same.

Hence a clearer case of infringement, and the infringement extends to the first and third Westinghouse claims.

This "modified" quick-action triple, by its piston marked 13, clearly establishes the fact that the piston 13 of the old apparatus was in substance the same, not only as a piston, but also as related to the auxiliary reservoir pressure which "actuated" it, and also to the emergency valve, to which, by an interposed column of air and an interposed piston, it "imparted opening movement."

In reply to the charge of infringement by the use of this "modified" valve, defendants repeated more or less of the defense previously made as to Plate V. They say, first, that the Westinghouse emergency piston "is not exposed to pressure on either side," and that in their device it is exposed to pressure on both sides. This involves an effort "both to misconstrue the invention and to mis-state the claim;" and is an effort to construe the claim by conditions which exist when the combination of the claim is not intended to be in operation. When the quick-action operation is desired, then auxiliary reservoir pressure is caused to be operative on the emergency pistons in the apparatus of defendants as well as of complainants, and in the same way to secure for the same result. When the train is running, or ordinary braking is done, it is immaterial whether the emergency piston is subject to pressure or not.

Defendants allege that the construction which they have adopted in their "modified" valve is taken from two patents. No. 162,465, of Ford, Westinghouse and Welsh, dated April 27, 1875, and No. 448,827, granted to George Westinghouse, Jr., March 24, 1891. The first has expired. The second is the third, in order of time, of the patents granted to Mr. Westinghouse for his quick-action invention. Its subject matter was originally included in the application for the second patent in order, that is, for patent 376,837 now in suit. By requirement of the Patent Office. this application was divided, and two patents were granted. Defendants now say, or *seem* to say, that as between these three patents, they are using the invention of the third.

This is no defence action. All three patents are for different parts of the same invention, and if defendants are infringing the third patent is no defense to that they are infringing the second. And this last question is the only one now before the Court. They *may* be infringing *both*, or even *all three*. We hope to make it clear in course of time that they *are* infringing the third, but at present the infringement of the second is the question.

The Ford, Westinghouse and Welsh patent was intended simply to aid the *releasing* of the old straight brake. It does not contain any part of a triple valve, nor has anything to do with *applying* the brakes, being used only for purposes of *release*, and differed in function as well as in combination.

The emergency valve of the quick-action brake *primarily hastens the operation of the next succeeding triple*. That is not within the limits of the Ford, Westinghouse and Welsh patent of 1875.

Hence, it can neither anticipate nor even remotely limit the claims, and cannot affect the question of infringement.

Had Mr. Massey and his company gone on perfecting their electro-vacuum brake, as they had a perfect right to do, there would have been no occasion for the present litigation. But they laid aside the abortive apparatus with which they thus commenced in 1887, and did nothing until 1890, nearly three years after Westinghouse had invented, completed, perfected, and put into actual use, in large numbers, the identical brake apparatus the patent for which lies at the basis of the present suit. On this point, Mr. Massey is condemned out of his own mouth. 1. "I was familiar with all three of these patents while I was inventing and constructing the emergency device of defendants' quick-action triple valve." 2. "But I actually appropriated nothing from either of these patents." It is a fair legal inference from the first statement that everything which he had done, in the line of an electro-vacuum quick-action brake, was a failure. An ingenuous inventor, who honestly desired to respect the rights of co-inventors, and especially of inventors who had succeeded where he had failed, would have been scrupulously careful to avoid imitation.

But Mr. Massey, in his self-assumed innocence, says: 2. he "actually appropriated nothing from either of these patents." He appropriated the method of working air brakes by causing the same pressure which actuates the triple valves in the ordinary work of braking, to actuate also an emergency valve connected therewith, in such manner as thereby to actuate the emergency apparatus of the next triple. It was a thing unknown until Westinghouse actually did it. Massey does not allege that he invented it himself, nor even that he ever thought of doing it until after Westinghouse did it. He had tried to do something else and had failed. But when he tried to do *this thing*, he appropriated the idea from Westinghouse, or from the Westinghouse patents, with which he says he was at that time "familiar."

He appropriated still further the method of doing this work by causing the auxiliary reservoir pressure to actuate a piston specially made for the purpose, so that it should move in the proper direction "to impart opening movement" to the emergency valve. This, too, was a thing unknown and unheard of until the success of Westinghouse made it a part of the art. And when Massey embodied that in his structure he appropriated something which did not originate with him, and which he could not have learned from any other source, for the reason that it had no other existence.

Mr. Massey has clearly "appropriated" the subject matter of claims 2, 3 and 6 of the patent in suit, but has endeavored to adopt a disguise which should conceal the things taken. The auxiliary reservoir pressure in the modified valve of defendants, operated directly on the emergency piston, at the time when motion is desired, exactly as the Westinghouse; the piston is exactly the same; the emergency valve is exactly the same; the emergency piston, as a result of auxiliary reservoir pressure, is actuated in exactly the same direction so as to impart exactly the same opening movement to the emergency valve, and the function performed thereby is exactly the same as in the Westinghouse patent. And all this was absolutely new with Westinghouse, and Mr. Massey knew it so to be. How then is it possible for him, in good faith, to deny that he has appropriated anything from this patent?

Massey's alleged valve of September, 1886, is not early enough, even if identical, for early the same month Mr. Westinghouse constructed and operated valves of this kind.

It would ordinarily be supposed that a person—and a corporation is a person in law—engaging in legitimate business, in a *bona fide* way, would seek to create a business of its own, rather than endeavor to engraft it onto, and by such engrafting, to appropriate to itself the benefits of the business of a successful competitor. Reasonable as this rule might seem, defendant has studiously avoided its application. In its published catalogue, it is said to be one of the chief recommendations of its system of apparatus, and one of the reasons why it should be adopted, that it is "interchangeable with the Westinghouse system." And this fact is stated with the utmost prominence, in large conspicuous letters, both there and elsewhere in the catalogue, and is repeated with such frequency as to show beyond all possible question a desire on the part of the defendant company to take all possible advantage which can be had, commercially or otherwise, from the known and universally admitted success of the Westinghouse system.

A fact which shows the *animus* of the present infringement is that the defendants have in their 1891 catalogue exactly reproduced large portions of the Westinghouse catalogue of the previous year, copying errors and all.

Defendants have also adopted a modification of the Westinghouse invention patented by Harvey S. Park, Dec. 4, 1888, No. 393,784, now owned by the Westinghouse Air Brake Company. Park introduced the working of the emergency valve piston by *train-pipe pressure* instead of by auxiliary reservoir pressure. These two pressures, measured in pounds force, are the same, but whatever advantage there may be due to the use of train pipe pressure instead of auxiliary reservoir pressure, for opening the vent valve, belongs to the Park patent.

The defendants in their first form or construction, Plate V., have used this feature of Park's invention. While they work piston 13 in such way as to embody the Westinghouse invention, it is equally clear that they work the piston 17 in such way as to embody the improvement made by Park. For on the depression or down stroke of the piston 13, the valve 14 is opened, and immediately thereupon train-pipe pressure from immediately below the valve 14 passes by the port *K* to the upper side of the piston 17, and by moving said piston is the direct agent for opening the vent valve 20.

Defendants clearly employ the Park invention when they provide for applying train-pipe pressure so that it shall work the *other* piston 17, or the one which completes the work which the first piston 13 had commenced.

The first claim of the Park patent reads as follows:

"1. In a brake mechanism, the combination of a valve controlling the direct passage of pressure from a train pipe to a brake cylinder, a piston connected to said valve and actuated wholly by train-pipe pressure, and a valve controlling the train-pipe pressure on the piston for opening and closing the communication between a train-pipe and a brake cylinder through the direct action of train-pipe pressure, substantially as specified."

The first element, "a valve controlling the direct passage of pressure from a train-pipe to a brake cylinder," is the emergency valve marked S in the Park drawing. The corresponding valve in the defendants' apparatus is the emergency valve 20.

"A piston connected to said valve and actuated wholly by train-pipe pressure" is the piston Q of the Park patent, and the piston 17 of the defendants' first form of valve, Plate V.

"A valve controlling the train-pipe pressure on the piston," refers to the valve M of the Park patent. In the defendants' first construction the corresponding valve will be found at 14.

The remainder of the claim, "for opening and closing the communication between a train pipe and a brake cylinder through the direct action of train pipe pressure," merely sets forth the purpose of the combination, which in defendants' apparatus is perfectly carried out in the manner already described.

The second claim of the Park patent reads as follows:

"2. In a brake mechanism, the combination of a train pipe, a brake cylinder, an interposed chamber communicating with the train pipe and brake cylinder, a piston in said chamber, a piston stem, a valve on the piston stem controlling the passage from the interposed chamber to the brake cylinder, and a controlling valve and passages for the admission of pressure from the train pipe to move the piston and open the valve, substantially as and for the purposes specified."

"An interposed chamber communicating with the train pipe and brake cylinder" means, of course, the emergency valve chamber, which equally is found in both devices.

The next element, "a piston in said chamber," has already been identified. It is the emergency piston *Q* of the Park patent, and the emergency piston 17 of defendant's Plate V.

"A piston stem" is common to both.

"A valve on the piston stem, controlling the passage from the interposed chamber to the brake cylinder," in the Park patent, is the emergency valve *S*, which controls the passage from the emergency chamber *P* to the brake cylinder *W*. In defendants' Plate V., the emergency valve does the same work and in the same way—that is, it controls the passage from that part of the emergency chamber which is just below it, to the brake cylinder, at the right hand side of the plate.

"A controlling valve and passage for the admission of pressure from the train pipe to move the piston and open the valve." This in the Park patent is valve *M*, which controls the pressure which moves the piston *Q*. In the defendants' Plate V, the corresponding valve is 14. While these two valves have little resemblance to the eye, they have the most striking resemblance as mechanical devices for controlling train-pipe pressures in its application to the emergency piston, and so that such train pipe pressure shall be utilized in moving the emergency piston so as to open the emergency valve.

This chief feature of the Park invention the defendants have clearly adopted in the construction of the device of Plate V.

Defendants base their denial of infringement by misstating the invention and misconstruing the claim.

Mr. Metcalf on cross-examination admits that defendant's quick action triple valve is "a structure in which an emergency valve is opened by the direct action of train or brake pipe pressure," also that such a structure is found in the Park patent, and still further that it is *not* found in the Westinghouse patent referred to. This feature is the point of novelty of the invention; a feature new with Park, and a feature which the defendants use.

Defendants' plain triple valve (Plate IV.) infringes the provision for graduating, shown in Westinghouse Patent No. 172,064; for a triple valve provision is made for a slight range of motion in the piston, sufficient in amount to open and close a supply without moving the main slide valve.

The third claim reads as follows:

"3. The slide valve *H*, made shorter than the distance between its end bearings, in combination with the port *s* and stem *c*, relatively arranged with reference to the operation of the valve *H*, while the port *s* is closed, substantially as set forth."

"The slide valve *H*" is the main valve of the triple. A little free space between its upper end and the adjacent collar *e* represents the lost motion, or the extent to which it is "made shorter than the distance between its end bearings."

"The port *s*" is the charging hole or port made in the piston *G* of the triple valve.

The "stem *c*" is the plug which, when the piston *G* comes down, closes the charging hole or port *s* in advance of the movement of the main valve *H*.

This combination has been adopted by defendants for graduating.

Plate IV. of defendants apparatus shows a slide valve marked 4, which corresponds, in function and operation, to "the slide valve *H*" of the Westinghouse third claim. This valve 4 is a little shorter than the distance between its bearings, so that the bearings along with the stem 6, to which they are connected, and

the piston 2, which operates them both, may move a little distance before they will move the valve 4.

This gives us the first element of the Westinghouse claim: "The slide valve *H* made shorter than the distance between its end bearings."

"The port *s*" of the patent will be found in defendants' apparatus, at the hole or port immediately to the right of the plug or valve marked 5, and this valve 5 corresponds substantially in structure, and is identical in function and operation, with the "stem *c*" of the patent, giving the remaining two elements of the combination.

Infringement is denied because in the patent the valve and port referred to are arranged in the piston so as to govern or regulate the supply of air from the train pipe to the auxiliary reservoir, whereas, in defendants' apparatus they use for this purpose a device taken from an old Westinghouse patent, No. 168,359, and that the valve and port in question are in their apparatus arranged at the other end of the piston stem so as to regulate the supply of air from the auxiliary reservoir to the brake cylinder. But a door is a door, whether it closes a barn or a bank or a bedroom. In the patent this air door is arranged in the piston, between the train pipe and the auxiliary reservoir. In the infringing device it is arranged at the other end of the piston stem, between the auxiliary reservoir and the brake cylinder. In either case it is operated by the piston itself. The slide valve 4 is simply another door, though in this case a sliding door. The claim says that these two doors must work in a prescribed order. The defendants use them in that order.

Defendants' engineer's valve contains every essential element of the Westinghouse construction, Patent No. 222,803, relatively arranged and combined.

The second Westinghouse claim reads:

"2. As a means for automatically cutting off the fluid-pressure supply when the desired pressure has been charged into the brake cylinders, a piston-head *P*, movable by the operative brake pressure or any excess thereof, in combination with the charging valve and a connection from one to the other, substantially as set forth, whereby such movement of the piston head will result in the automatic closing of the charging valve substantially as set forth."

We find in defendants' apparatus. "a piston head" 32, "movable by the operative brake pressure or any excess thereof," which pressure comes in through the charging valve 39, "in combination with the charging valve" 39, "and a connection from one" (say, the piston 32) "to the other" (say, the charging valve 39), "substantially as set forth, whereby such movement of the piston head (32) will result in the automatic closing of the charging valve (39), substantially as set forth"; and this combination constitutes what is specified at the beginning of the claim: "a means for automatically cutting off the fluid-pressure supply when the desired pressure has been charged into the brake cylinders."

The third claim reads as follows, the figures which in defendants' apparatus are used to designate the corresponding devices being inserted in parentheses.

"3. The combination of piston head (32), charging valve (39), interposed stem (43, 49), and escape valve (42) substantially as set forth with reference to the opening and closing of the charging valve (39) without necessarily opening the escape valve (42), substantially as set forth."

"4. The combination of piston head (32), charging valve (39), interposed stem (43, 49), escape valve (42), and a single operating stem (50) adapted by independent connections with both valves (39, 42) to shift both by independent successive motions, substantially as set forth."

The admissions made by defendants' expert *Carpenter*, on cross examination, render it unnecessary to answer denials of infringement. In the questions asked Mr. Carpenter, the words and phrases taken from the claims are italicized.

Cross-Int. 28. Referring you to defendants' Engineer's Valve, as shown in Plates 2 and 3 of defendants' catalogue, is it not the fact that you find therein a shell or case marked 31, 38, 40 and 41, and containing a *piston chamber* closed at top by the head 41, and a valve chamber closed at top by the cap 38?

Ans. Yes.

Cross-Int. 29. You also find in it, do you not? a *piston head* 32 adapted to work in the piston chamber and to be *moved by the operative pressure or any excess thereof?*

Ans. Yes.

Cross-Int. 30. You also find therein, do you not? a *charging valve* 39?

Ans. Yes.

Cross-Int. 31. You also find therein, do you not, a *connection between the piston head* 32 and *charging valve* 39, consisting of a bell crank lever 49, a pin 48, a lever 43 and a stem or projection on the piston head 32?

Ans. Yes.

Cross-Int. 32. You also find, do you not? that in defendants' Engineer's Valve, by reason of the connection from the piston head to the charging valve, movement at the piston head, under the operative pressure or any excess thereof, will result *in the automatic closing of the charging valve?*

Ans. Yes.

Cross-Int. 33. You also find, do you not? in defendants' Engineer's Valve, a piston head 32, a charging valve 39, and an escape valve 42, and interposed connections 49, 43 and 48, so arranged that *the charging valve may be opened and closed without necessarily opening the escape valve?*

Ans. Yes.

Any contention of want of novelty in Patent 222,803, upon the ground asserted by defendants' witnesses, is wholly without merit, will be apparent from the cross examination of Mr. Metcalf, in which he says:

Cross-Int. 52. You have referred in the last paragraph of your answer to the question 18 in chief to the Fay & Cairns patent No. 129,015 as containing some of the elements of the combination which you state to be the invention of the Westinghouse patent 222,803?

Do you find the Fay & Cairns patent to describe or show any structure designed for or capable of performing the functions set forth in Patent 222,803 or of defendants' engineer's valve?

Ans. The Fay & Cairns structure could only perform a part of the functions of Patent 222,803, or of defendants' Engineer's Valve, as it contains only a charging valve and no exhaust.

Cross-Int. 53. It could not in practice be substituted either for the structure of Patent 222,803 or for defendants' Engineer's Valve, could it?

Ans. Manifestly it could not.

Cross-Int. 54. It describes and shows simply and solely a pressure regulator or pressure reducer, does it not?

Ans. Yes; if in the term "pressure regulator" is included the idea of varying the tension of the spring by turning the screw cap.

Cross-Int. 55. The feature of adjustment to which you have referred does not make it any more or any less than what is well known in the art as a "pressure regulator," does it?

Ans. No.

Cross-Int. 56. You also refer in the last paragraph of your answer to Question 18 in chief to the Westinghouse patent 141,685 as containing some of the elements of the combination which you state to be the invention of the Westinghouse patent 222,803?

Do you find that Patent 141,685 describes or shows any structure designed for or capable of performing the functions set forth in Patent 222,803, or of defendants' Engineer's Valve?

Ans. Not at all. The structure shown in Patent 141,685 is a triple valve, and a triple valve and an engineer's valve are neither equivalent nor interchangeable so far as I know.

In conclusion it is submitted that all the patents sued on are incontestibly valid, to the full extent of the terms of the several claims enumerated; that the defendants have infringed each and every of said claims; that their defenses are without equity; and that complainants are entitled to a decree for an injunction and account with reference to a master, in each of the two actions.

(To be continued.)

When Is a Locomotive Worn Out?

The discussion on this subject at the December meeting of the New York Railroad Club was generally in favor of breaking up a locomotive when the expenses of repair would amount to $3,000, or about 35 per cent. of the original cost. Mr. Blackall stated that he broke up all engines having cylinders 16 in. by 24 in. or under. Mr. A. E. Mitchell had few engines with cylinders under 18 in., and condemned old engines having cylinders below 17 in. If 18-in. cylinders have small boilers and the repairs will cost over $3,000 they are broken up. Light engines are seldom rebuilt if over 15 years old. Mr. Mendenhall (Pennsylvania) remarked that the policy of his company was to get odd engines out of service in order to use a standard which applied to 99½ per cent. of the whole number. Little is thrown away of standard engines except the boiler and cylinders if badly worn. Mr. W. F. Dixon (Rogers Locomotive Works), Mr. H. L. Leach (Boston) and others remarked that the cost of repair required in a general overhauling was often $3,000 to $5,000, or greatly in excess of the amount thought necessary on a cursory examination. Mr. Blackall, Mr. Ennis (New York, Susquehanna & Western) and others stated that the boiler plates of old engines were frequently in worse condition than anticipated. Mr. Angus Sinclair alluded to the frequency of grooving near the water line. Mr. Miller (New York & Northern) thought that rigid inspection would alone determine when an engine should be put out of service, and never condemned an engine until this was done.

A discussion then took place on the influence of average speed, including delays, upon the cost of running engines. One member complained that, owing to bad train dispatching and lack of side track and terminal facilities, his engines only averaged five miles per hour. All agreed that this was an exceedingly low rate and must largely augment expenses and call for a large increase in the number of engines to work a given ton or train mileage. Mr. Blackall paid his men by the mile, 100 miles constituting one day's work. The business could not be handled at five miles per hour, and the consumption of fuel would be largely increased. Mr. Mitchell also paid by the mile, 100 miles being a day's work on the Eastern Division and 90 miles on the heavier divisions. Such a slow speed would mean a lot of overtime. One ton of coal would maintain a fire over night. Plenty of side tracks saved their cost in fuel at that rate. Mr. Geo. R. Brown (Fall Brook Coal Co.) said that slow speed meant extra wages and extra fuel, and that the policy of his road had been to increase side-track facilities above the average, and that this had reduced delays.

The question of blind tires was then discussed, and the general opinion seemed to be against their use on 10 wheeled and consolidation engines. Mr. Lewis (Delaware, Lackawanna & Western) put flanges on all tires of all 10-wheel and moguls, first flange to gauge; second, ⅛ in. play; third, $\frac{3}{16}$ in. play. Mr. Chas. Graham, of the same road, wrote that the use of all flange wheels on consolidations had been very satisfactory with a rigid wheel base of 15 ft., giving front and back ⅛ in. play and two middle pair ⅝ in. each. The proper length of radius bar and lateral play of engine truck were important. Found that 4-ft. radius bar enabled these consolidations of 22 ft. total wheel base to pass round 11 deg. curves (521 ft. radius) without flange wear. Plain tires often dropped off on this curve. Mr. Blackall had similar experience, but gave less lateral play, even for 22 deg. curves, and had no trouble. Mr. Angus Sinclair said that plain tires were being generally abandoned in the West.

Railroads in Bolivia.

The Hon. Thomas H. Anderson, late U. S. Minister to Bolivia, furnishes to the Bureau of the American Republics the following information regarding the railroads and telegraph lines in that country.

Bolivia has two lines of communication with the Pacific Ocean, One by the Antafogasta & Oruro Railroad, covering between seven and eight hundred miles, and the other by the Mollondo & Araquipa Railroad, thence by steamer across Lake Titicaca to within forty miles of La Paz, covering about five hundred miles. The Bolivian government has lately made liberal concessions for the construction of railroads from the interior of the country to the navigable waters of the Amazon and the La Plata. One of these concessions has been granted to Gen. Thos. O. Osborne, of Chicago, President of the Paraguay & Bolivia standard gauge railroad, now under construction to Asuncion on the Paraguay River. After entering Bolivian territory this road will reach Sucre, the capital of the republic, and thence pass through the great mining district of Huanchaca and Oruro to La Paz, thence along the east shore of Lake Titicaca into Peru, connecting with the Southern Peruvian railroad system in the neighborhood of Santa Rosa, south of Cuzco. When this road is built it will be one of the most important enterprises for Bolivia yet undertaken, and is so located that in the very nature of things it will constitute in whole, or at least for the greater part, the Bolivian link in the Intercontinental Railroad. It is a fact that is not generally known that no part of the Intercontinental Railroad system south of the Isthmus is so easy of construction and will be attended with so little cost as that falling within Bolivian territory. It will cross the great elevated plateau of Eastern Bolivia, which is practically a level country from one end of the republic to the other, and offers no engineering difficulties whatever.

The telegraph lines of Bolivia are owned by the government, and are being rapidly extended. The capitals of all of the departments are connected by wire, save that of Santa Cruz, in eastern Bolivia, toward which, however, a line is now building.

The main resource of Bolivia is silver mining, and Mr. Anderson thinks the mines are much more extensive and persistent than the mines of our own country, though they all require capital to develop them. In addition to silver there are large deposits of gold, tin, copper, bismuth, etc., but requiring improved facilities for transportation before they can be worked to advantage.

Nine Lake Freighters.

The *Marine Review*, Cleveland, O., prints some data furnished by M. A. Hanna & Co., who have managed nine propellers in the ore trade during the past season. Taking gross amounts and averages, the information is tabulated as below:

	Gross amounts.	Averages.
Number of boats	9	.....
" " trips	302	.....
Miles run	369,073	1,222.1
Ore carried, net tons	880,029	2,914
Ton mileage	1,075,479,940	3,561,199
Hours in motion	30,226	.....
" loading and coaling	15,121	.....
" repairing	1,483	.....
" delayed by storms	1,451	.....
Speed, land miles	.....	12.21
Coal used, pounds	81,683,000	.....
" " per mile, pounds	.....	220.46
" " " ton mile, ounces	.....	1.21

The table apparently gives partial statistics for 302 round trips. The total miles run is given and the total ore carried, but nothing is said about other freights, which were presumably carried in the opposite direction. The ton mileage is apparently figured on the average length of the trip and the average cargo of ore. This would not seem to give exactly reliable figures for the coal used per ton mile, but the coal used per mile is apparently correct and is a good performance, inasmuch as it probably includes some light mileage. This performance may be compared with that of the Minnesota Steamship Company's steamer "Manola," whose performance has been frequently quoted. The general average speed of the "Manola," in 1890, was 12.25 miles per hour, while the average speed loaded was 11.85 miles per hour, and the average speed light 12.72 miles. The coal consumption per mile was 209 lbs. light and 226 lbs. loaded, giving a general average of 218 lbs. per mile. The average fuel used per ton mile was 1.5 ounces.

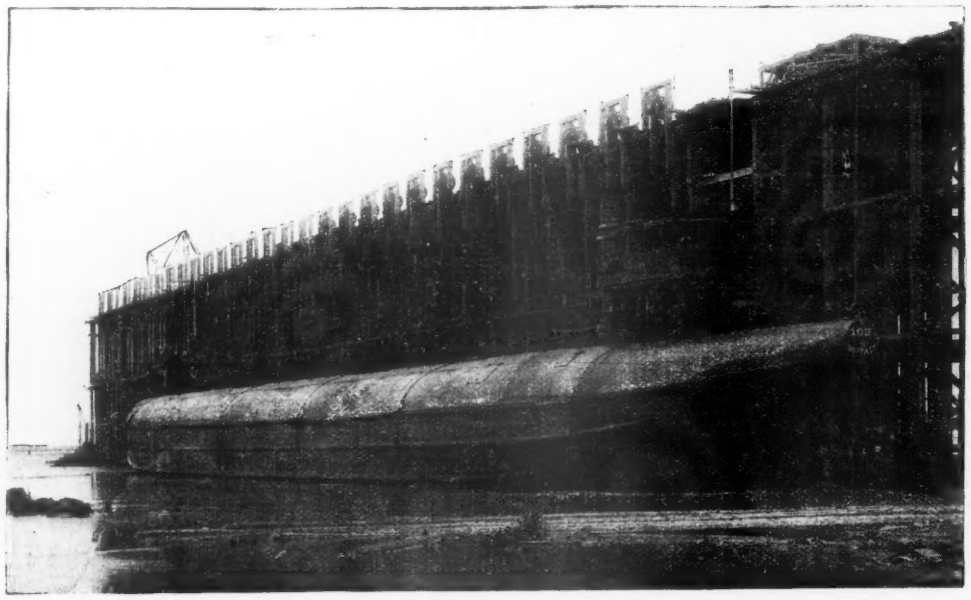
It will be noticed that almost exactly 94 per cent. of the time returned in the table was employed in actual service, while about 3 per cent. of its time was lost in "repairs, dry dock, etc." and an equal amount on account of weather. Of the whole time 62.6 per cent., or five-eighths, was expended in carrying cargo. As the average length of a voyage was only 611 miles, the despatch in loading and unloading is as satisfactory as the average speed of 10.59 knots. Up to 1850 or '55 American ships on the ocean were noted for both their speed and general efficiency. So that they usually secured freights before those of any other nation and at a higher price. Our lake marine seems to be conducted on the old American plan, and in fact does some 93 to 94 per cent. of the lake traffic.

The Playful Railroad Officers of Jersey City.

The Lehigh Valley and Jersey Central Railroad companies came to open conflict Wednesday night over the Morris Canal water right at the foot of Jersey avenue, Jersey City. The Lehigh owns the canal, but the local Street and Water Board recently gave the Central permission to span it at Jersey avenue with a bridge. This temporary structure had been completed Wednesday, and, the better to block the water way, the Central lashed a scow to the bridge in the middle of the stream. The Lehigh Valley people permitted the work to go on without interruption till it had been completed. Late Wednesday night, however, a locomotive was brought to the scene, and used to demolish the work. Hawsers were fastened to the bridge trusses, and the locomotive tugged away at them till the structure had been pulled apart. Then the engineer turned his attention to the obstructing scow. That was not only heavily laden, but it was the more securely fastened by its surrounding of solid ice. The hawsers were fastened to the cleats, however, and for an hour the locomotive backed to slacken the line, and then dashed forward to release the imprisoned scow. Then the ice cracked, the scow was dislodged and towed down the stream and sent adrift. . . .—*New York Times.*

Whaleback Barges and Steamers.

We show two illustrations from photographs which have a certain value in the literature and curiosities of the "whaleback," which has already become a pretty important institution on the Great Lakes. One is a view taken in the shipyard of the American Steel Barge Co., last April, showing a number of vessels on the stocks in various stages of the work. This gives some dea of the magnitude of the yard and of the volume of work done there last summer, as well as of the construction of the vessels themselves.



Whaleback Barge at the First Ore Dock Built at Superior.

The other illustration shows a whaleback taking out the first cargo of Mesaba ore from the first ore dock built at Superior, Wis.

The La Burt Vertical Plane Coupler.

The construction of this coupler is so plainly shown in the illustrations that its action will be readily understood. The main novel feature is the knuckle pin, which

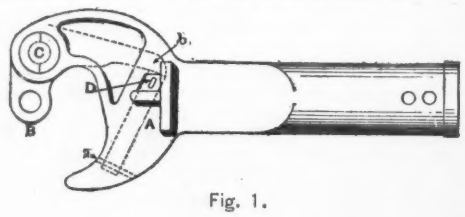


Fig. 1.

is made in a peculiar form so as to throw open the knuckle automatically.

The underside of the head of the knuckle pin is made with a spiral, so that the pin rises as the knuckle is forced to the coupled position and falls as the knuckle opens. The knuckle, being fast on the pin, has a tend-

Fig. 4. Fig. 3.

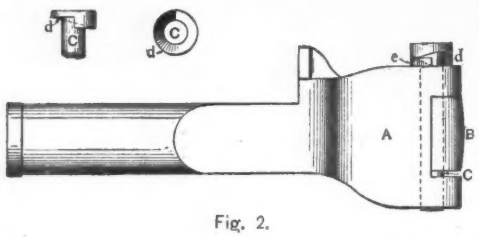


Fig. 2.

ency to overcome the friction of the pin on the head of the coupler and open as the pin and knuckle fall. The locking arrangement is clearly shown in fig. 5 and in plan in fig. 1. The drawhead is made of malleable iron and the knuckle of steel. The weights are: drawhead, 150.5 lbs.; knuckle, 35 lbs.; pivot-pin, 7lbs.; total, 192 5 lbs.

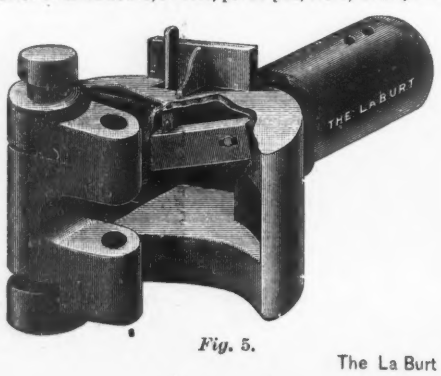


Fig. 5.

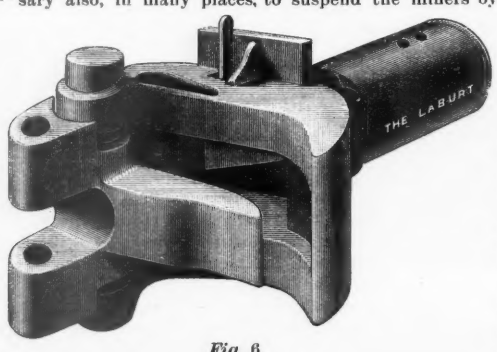


Fig. 6.

The La Burt Vertical Plane Coupler.

The Congo Railroad.

The Belgian Consul-General, in his report on the Congo Free State, says the surveys for the construction of a railroad from Matadi to Stanley-Pool occupied from May, 1887, to January, 1889. In October, 1889, the first engineers departed with a certain number of artisans, and others joined them in March, 1890. In the first place, it was announced that the total construction of the railroad would not take longer than four or five years, but this was through insufficient attention being given to the difficulties presented by the first part of the route, that is to say, the first 23 kilometres, and more especially of the first eight up to the bridge over the river Mpozo. After a deviation from the first plan this section was executed, and now that it is in operation how considerable were the difficulties that had to be overcome may be appreciated. The line penetrates enormous rocks on the banks of the river up to the Leopold ravine, where it is about 50 metres above the waters of the rapids. From this point and at the same elevation, it enters the valley of the Mpozo, following the west bank of the river, and for a distance of eight kilometres the line dug out of the rocks is literally hung upon the sides of the mountains, perpendicularly overhanging the waters of the river and thrown over a multitude of ravines. The bridges, foundation walls, aqueducts and protective works against water are accumulated there. The importance of the water question will be understood when it is known that the level of the Mpozo rises sometimes seven metres in a night, in spite of the excessive declivity of the river bed. It was necessary also, in many places, to suspend the miners by ropes to start the attack on the perpendicular walls. To-day, in traversing this part of the line, one can realize the difficulties that the engineers had to conquer. It is an extremely bold work, which astonishes and excites admiration; one asks how it came to be attempted in Africa.

The next noticeable work is the single span iron bridge, 60 metres in length, thrown in a slightly oblique direction over the river. From thence the right bank of the river is followed, and the line arrives at 23 kilometres by skirting the Palaballa group, so far declared impassable. All earthworks were completed as far as this point when the Consul-General wrote, and by now this new part of the railroad should be in operation. All difficulties of construction disappear from this point, and the route lies through a fine valley where the line can be laid with rapidity. According to the engineers, the railroad can progress now at the rate of 100 kilometres a year, the remaining part of the line being nothing as compared with the first 23 which have been completed. It is necessary to bear in mind the difficulties that have to be encountered with black labor. They know, at first, nothing of the work, have never seen a shovel nor a pickaxe; and when they commence to know how to work, they have arrived at the termination of their period of service.

Statistics of the Fractures of Tires on the German State Railroads from 1884 to 1890.

The statistics of the fractures of railroad tires is interesting, showing, firstly, what a large number take place; and, secondly, in what direction steps should be taken to reduce them. Over a period of seven years, from 1884 to 1890 inclusive, for every hundred wheels 0.28 tires fractured; or, to put it in other words, more than one fracture occurred for every 200 axles. In some cases the figures show even a worse result when classed under their various heads as follows:

In 100 locomotive wheels,	0.5	fracture occurred.
" 100 tender wheels,	0.65	" "
" 100 passenger-carriage wheels,	0.38	" "

In 1890 alone in Germany, 30 trains left the rails through the fracture of wheel-tires, and there is no concealing the fact that herein lies a great source of danger, to diminish which every effort should be made. These efforts should be in two directions, first, to diminish the actual number of fractures; and, secondly, should a fracture occur, to prevent any portion of the tire breaking off, thereby diminishing the likelihood of the train leaving the rails.

The fractures may be due to the high stresses set up in the tires themselves, due to their being shrunk on and consequent contraction; but the author holds that in general these high stresses do not occur frequently, and thinks the main cause of fracture to be more likely due to the hammering action of the rails.

The thinness of the tire has a very marked effect on the number of fractures, as will be seen by the following table:

For every 100 tires over 2.362 in. thick, 0.025 fracture occurred;

For every 100 tires from 1.968 in. to 2.363 in. thick, 0.08 fracture occurred;

For every 100 tires from 1.575 in. to 1.968 in. thick, 0.29 fracture occurred;

For every 100 tires from 1.378 in. to 1.575 in. thick, 0.54 fracture occurred;

For every 100 tires from 1.181 in. to 1.378 in. thick, 1.05 fracture occurred;

For every 100 tires from 0.984 in. to 1.181 in. thick, 1.65 fracture occurred;

For every 100 tires from 0.787 in. to 0.984 in. thick, 1.85 fracture occurred.

If the thinnest were from 1.181 in. to 1.378 in. the number of fractures would be considerably reduced. It must be admitted, however, that even now, with small thicknesses of tire, the loss of material is considerable, and this would be increased with the greater thicknesses; but with the present perfection of manufacture the author does got anticipate any difficulty in the manufacture of these heavy tires, and therefore holds that they should be applied to reduce the number of failures that occur. He quotes two further methods whereby the number of fractures may be reduced—(1), that of spring rings, which proved successful in 1,146 cases out of 1,197; (2) by that of specially forced rings, which were successful in every case out of 69 cases.

Ship Yard of the American Steel Barge Company—West Superior, Wis.

Car Lighting.

Two new Pintsch gas plants were put in operation on Jan. 24, one at Kansas City and one at Toledo.

* Abstracts of Papers—Institution of Civil Engineers.

The Brown Segmental Wire-Gun.*

Among the objects of interest which the members of the Institute of Mining Engineers were invited to examine in connection with the Schuylkill Valley meeting at Reading last October was the Brown segmental wire-gun, in process of construction at the works of the Pennsylvania Diamond Drill & Manufacturing Co., at Birdsboro. This is a 5-in. breech loading (high-power) rifle, 19 ft. long, constructed upon the system of Mr. J. H. Brown, an inventor of recognized genius in many branches of mechanical industry, and under the engineering direction of Lieut. G. N. Whistler, Fifth U. S. Artillery.

The system consists essentially of the subdivision of the inner core or tube of the gun, which takes up the initial compression, into longitudinal segments of such size that a higher physical condition and degree of special elasticity may be set up therein than it is possible to produce in the larger masses of metal heretofore used for the tube of the modern high power cannon. The process consists in winding layers of square steel wire subjected to a constant tension of 130,000 lbs. per sq. in. around these segments, which, when so held together, form the tube of the gun. A lining tube may or may not be used. The steel segments used in the gun now under construction are 18 ft. 4 in. long and 3 in. thick at the breech, from which they taper to 0.8 in. at the muzzle. The physical condition of the segments has been determined by a testpiece, cut from each end of each segment, which showed the following characteristics: Tensile strength, 165,000 lbs. per sq. in.; elastic limit, 105,000 lbs. per sq. in.; elongation at rupture, 14 per cent. at 2 in. They are of crucible chrome steel, made by the Carpenter Steel Works, at Reading, Pa. The wire which holds them together has 0.005 sq. in. sectional area, and is wound under a constant tension of 650 lbs. on each strand, equivalent to 130,000 lbs. per sq. in. The winding has been done by a machine designed for the purpose by Mr. Brown. The wire used has the following physical qualities: Tensile strength, 250,000 lbs. per sq. in.; elastic limit, 200,000 lbs. per sq. in.; torsional strength, 30 full turns in 8 in. before breaking.

Following the curve of maximum pressure, the segments are wound at the breech with 33 layers of wire, making a total thickness at that place of 2.31 in. of wire, and a layer is dropped at each 10 in., so that there are but 10 layers at the muzzle, giving at that point a thickness of 0.71 in. Altogether, 3,256 lbs. of wire were used, equivalent to a single strand extending in a straight line 37 miles. As no flow of metal will occur below the the elastic limit of the steel of which the segments are made, enlargement of the bore will not take place below a pressure of 94,000 lbs. per sq. in.—this being 94 per cent. of the elastic limit if that limit be taken at 100,000 lbs. per sq. in. (the minimum obtained from any one of the testpieces). As the pressure between the segments at the surface of the bore, induced by winding, is 100,000 lbs. per sq. in., it will require a powder pressure of 63,200 lbs. per sq. in. to reduce this compression to zero

* Extract from a paper by N. B. Wittman.

TECHNICAL.

Manufacturing and Business.

The Caswell Car Company of Chicago was chartered in Illinois last week with a capital of $50,000 to build and operate cars for the transportation of live stock. The incorporators are W. A. Caswell, John M. Cameron and others.

The Jones Car Works, at Rotterdam, N. Y., have been sold to E. C. White & Co., of New York, for $65,000. The purchasers are manufacturers of car wheels, car trucks, etc.

The Boston Belting Co. now employs over 500 operators and uses annually over 3,000,000 lbs. of cotton duck and cloth and about 4,000,000 lbs. of rubber in the manufacture of rubber goods used by railroads and car builders. The business was established in 1823, and the company can claim to be the oldest and largest manufacturer of mechanical rubber goods. The Manufacturing Agent and General Manager, Mr. James Bennett Forsyth, has been connected with the company more than a third of a century, and is the patentee of most of the inventions controlled by the company.

The Boies Steel Wheel Company, of Scranton, Pa., has removed its New York offices to No. 39 Cortlandt street, where Mr. H. W. Boies, Vice-President, will make his headquarters and have charge of the sales departments. Messrs. Coolbaugh and Pomeroy have resigned their connection with the company

Mairs & Lewis, 18 Broadway, New York City, have taken contracts for building something over a mile of heavy trestle on the Wilkes-Barre & Eastern Railroad, near Wilkes-Barre, Pa. Also about a mile of trestle on the Niagara Falls and Junction road at Niagara Falls, N. Y. They have just completed five trestle bridges on the Johnsonburg & Bradford road, one of these over the Kinzua Creek being about 80 ft. high. They are now engaged in constructing a large saw mill for L. Buckie & Son, at Jacksonville, Fla., and also large docks in connection with this mill.

Iron and Steel.

The directors of the Thomas Iron Company this week elected Benjamin F. Fackenthal, of Easton, Pa., President of the company to succeed the late John T. Knight, who died in December. Mr. Fackenthal was for some years Superintendent of the firms of Cooper & Hewitt, at Durham, N. J.

Automatic Brake Failures in Great Britain.

The Vacuum Brake Company, limited, of 32 Queen Victoria street, London, has issued a circular showing the total brake failures on the roads of Great Britain, as reported to the Board of Trade, for the half year ending June 30, 1892. The Board of Trade report divides these failures into what may be called the dangerous and the non-dangerous classes; but no totals are given, so that the number of faults, as reported in this circular, must have been added up by the compiler of the circular. The report in the official blue book occupies about fifty pages. The failures under the "dangerous" headings are extremely few, and the totals given may be taken as representing, substantially, only those accidents which simply caused delay or inconvenience.

The number of miles run by trains fitted with the Westinghouse automatic was 25 millions, and by trains fitted with the Vacuum automatic, 52 millions; and the number of faults 264 and 271, respectively, making the result:

Westinghouse, 1 fault per 95,512 miles run.

Vacuum, 1 fault per 191,956 miles run.

Non-automatic brakes are also shown in the circular, but there were less than three million train miles with these. These reports, like many railroad reports in this country, indicate either great differences in the care and skill with which work is done on different roads, or else great differences in the thoroughness with which records are kept. Thus the London, Brighton & South Coast, with 3,591,506 train miles (Westinghouse automatic), had 26 faults, while the London, Chatham & Dover, with 1,826,092 miles, had 38 faults. The Lancashire & Yorkshire, running 4,614,850 miles with the Vacuum automatic, had 32 faults, and the London & Northwestern, running more than twice as many miles, reported precisely the same number.

Moving Sidewalk at the World's Fair.

Contracts have been let for the construction of 4,500 ft. of movable sidewalk on the casino pier of the World's Fair Grounds. The sidewalk is designed principally to carry passengers arriving by steamboats from the lake end the pier to the shore, 2,500 ft. westward. The Pier Movable Sidewalk Company owns the concession granted by the World's Fair for a display of this novel and useful method of transportation on the casino pier. Pullman's Palace Car Company has the contract for the entire rolling stock, the General Electric Company for the motors and electrical equipments and Hiero B. Herr & Company, the contractors who have just finished the pier, will build the substructure for the moving platforms. The plans call for the movable platforms to be five feet above the floor of the pier so as to afford to all its passengers an elevated and unobstructed view of the shore and lake. The directors of the company are William Eliot Furness, Max E. Schmidt, George F. Brown, General Manager of the Pullman's Palace Car Company H. B. Herr, J. L. Silsbee, Dr. Arnold P. Gilmore and F. W. Cookin. Work will be commenced at once.

Nickel Steel for Boilers.

The use of nickel steel for armor has been so successful that it has led the ordnance departments of our government to propose using it for guns, and the navy to use it for various machinery parts, and now it is proposed by the Detroit Dry Dock Company to employ it in the construction of boilers. It is claimed that a tensile strength of 90,000 lbs. can be secured without loss of ductility. The weight of the shell can be reduced to about two-thirds of the weight necessary with ordinary steel. Mr. McMillan, the secretary of the company, is now consulting with both the Board of Supervising Inspectors and Carnegie, Phipps & Co. as to the practicability of the plan, which promises a decided advance in boiler construction.

Mountain Iron Co.

As a result of the furnace tests of the ore shipped just before the close of navigation from the Mountain Iron Co.'s mines on the Mesaba range, in Northern Minnesota, that company and the interests associated with it have been enabled to raise, by the sale of bonds, $12,000,000. Of this sum $4,000,000 will be used in building an independent railroad to the head of Lake Superior and terminals at that point; the second $4,000,000 is for the American Steel Barge Co., and will be expended in the construction of additional "whalebacks" for carrying the ore; the third $4,000,000 will be expended in providing terminals on Lake Erie. It is anticipated that the American Steel Barge Co. will carry to the East from this range at least 3,000,000 tons of ore during 1893.

Car Heating.

The Martin Anti-Fire Car Heater Co., of Dunkirk, N. Y., has an order to equip a trial train on the Queen & Crescent, consisting of an engine, baggage car, smoking car, day passenger, and parlor car.

THE SCRAP HEAP.

Notes.

The car shops of the Pittsburgh & Lake Erie, at Chartiers, were destroyed by fire on Sunday night last; loss, $65,000. The fire was caused by a leaking natural gas pipe.

The Wabash road has recently discharged a number of telegraph operators and the cause is said to be their failure to avow their sentiments as regards allegiance to the telegraphers' brotherhood.

The California Superior Court, following the lines laid down by the United States Supreme Court in the Chicago lake front case, has rendered a decision in San Francisco, holding that the Southern Pacific Company had no title to the water front of Oakland, 11 miles in extent. The case had been on trial since last August.

Charles J. Carroll, the telegraph operator of the New London Northern, whose recklessness caused a collision resulting in the death of five men on Oct. 14 last, was sentenced in the Superior Court at Norwich last week to one year in jail and costs. If the costs are not paid his term of imprisonment will be about sixteen months.

The fuller reports of the decision of the New York State Court of Appeals in the case of Superintendent Phyfe, charged with violating the hours-of-labor law indicate that the court did not discuss the constitutionality of the law, as was at first stated, but simply pointed out that the acts charged against Mr. Phyfe did not violate the statute, which declares that 10 hours shall constitute a day's work, but does not forbid a man working two such days within 24 hours.

The Lake Erie & Western resumed operations in its yard at Muncie, Ind., last Sunday, after about ten days' suspension on account of the strike. There was much difficulty, however, and the new men were hampered in their work by large and ugly mobs. Several of the strikers have been bound over for trial and have been punished for contempt of court. There has been a considerable strike of boilermakers at the shops of the Brooks Locomotive Works at Dunkirk, N. Y., for three weeks, and on Tuesday last the strikers succeeded in inducing other workmen to join them so that 1,000 men—five-sixths of the entire force—were out. The "Brotherhood of Railway Employés" has rented "elegant office rooms" for the grand lodge at Albuquerque, N. M. So far as can be judged from the reports, the "grand" part of this organization is more important than its constituency.

The unusual weather of the past month caused much suffering in the South. The Richmond & Danville road gave 10 car loads of wood to the city officials of Atlanta for distribution to the poor. A railroad company had to come to the rescue in Ohio, also. The village of Upper Sandusky received a loan of three car loads of coal from the Columbus, Hocking Valley & Toledo. The supply had become so low that families were allowed only half a ton each when the three cars arrived. The retail price of coal in Philadelphia, which was raised by some dealers on account of the scarcity, was restored to the ordinary figure within a day or two. The unusual ice embargo resulted in a serious scarcity at Boston and the retail price was raised 75 cents on Jan. 19. On Friday last the telegraph lines on many miles of railroad in South Carolina were broken down by a severe wind storm.

World's Fair Notes.

Mr. Geo. Chesworth, of the London & Northwestern Railway, of England, was in Chicago lately for the purpose of arranging for the installation of the exhibit of that company. The principal features of this exhibit are a passenger train headed by a Webb compound locomotive weighing 47 tons, a model ticket office, full size models of Geo. Stephenson's "Rocket" and Trevithick's locomotive of 1804, and a representation of the L. & N. W. signaling system. The locomotive is to be shown over a pit, so that it can be examined from underneath. The Lake Shore & Michigan Southern has offered the services of its engineering department for constructing the pit. This exhibit will come by the White Star Line of steamships and the New York Central and the Lake Shore & Michigan Southern railroads. Mr. F. W. Webb, Mechanical Superintendent of the London & Northwestern, will be present at the opening of the exposition.

The Engineers' Club.

A great many of our readers know that the Engineers' Club (New York City) began three years ago the practice of having informal dinners every fortnight through the winter. These dinners are presided over by a chairman selected for the evening, who, with the entertainment committee, arranges some plan of amusement to follow the dinner. These affairs have been almost uniformly successful and have become popular. Last Saturday evening one of the best of the whole series was held, with Prof. J. E. Denton in the chair. There were over 90 men present, and there was a really unusual air of gayety and high spirits and good fellowship pervading the whole party. The after dinner entertainment consisted of some short speeches, the reading of verses original or selected, a song or two and a violin solo, by members of the club. It is probably well known that the membership of this club is not confined to engineers as the name would indicate, but that it is composed of engineers and business and professional men of allied interests. The number of engineers who are engaged in strictly professional work and in various branches of manufacture considerably predominates in the membership, and such men are constant frequenters of the club. The consequence is that it is a very agreeable resort for engineers and their friends.

The Nancy Hanks Trains.

The Central of Georgia has lately put on a regular passenger train which is scheduled at about 48 miles an hour for 191 miles, including stops. As these stops are somewhat numerous and not very short, the actual speed of the train is high. In fact, if the local newspapers are correct, it ran over a week before it succeeded in getting to destination on time. An officer of the road sends us the following particulars:

The trains referred to are our "Nancy Hanks" trains; leaving Savannah (No. 1) at 7 a. m.; reaching Macon, 191 miles, at 11 a. m.; leaving Macon at 11:15 a. m.; reaching Atlanta, 103 miles, at 1:45 p. m., or 6 hours and 45 minutes for the 294 miles, with 15 minutes lie-over in Macon. Coming south the train is No. 2, leaving Atlanta at 1:30 p. m., reaching Macon at 4 p. m.; leaving Macon at 4:15 p. m., reaching Savannah at 8:15 p. m. The stops for both trains are, besides Macon: C. & S. crossing three miles from Savannah; Guyton, 30 miles; Millen, 79 miles; Wadley, 107 miles; Tennile (railroad crossing), 135 miles; Gordon (Junction), 170 miles; Forysth, 217 miles; Barnesville, 234 miles; Griffin, 251 miles (railroad crossing); Jonesboro, 274 miles, and No. 1 also stops at Hapeville (end of double track), 286 miles, to register; and also at M. & A. junction near Macon for same purpose. No. 2 does not make these two stops. We also have to contend with an arbitrary time of 30 minutes for five miles through the city limits of Atlanta.

The train consists of a parlor car, a first-class car, a partition car (smoker and compartment for colored passengers) and a mail and baggage car; a four car train, no express being handled on these trains.

The trains are hauled by three Baldwin compound engines, each weighing 105,000 lbs. These trains are thus far very popular with passengers.

Freight Movement through Harrisburg.

Harrisburg freight yard is one of the largest on the Pennsylvania road, being at the junction of the main line with an important north-and-south road, the Northern Central. The traffic here is therefore an index of the general business. During December 1,488 trains with 75,585 loaded and 1,573 empty cars passed through this yard east bound, and during the same period 1,346 trains with 13,940 loaded and 52,067 empty cars passed westward. This is equal to 2,489 cars east, and 2,129 west, daily. The record of the number of trains appears to have been made up from the departures.

An Editor Who Refused a Pass.

An Ohio editor yesterday returned to General Passenger Agent Charles O. Scull a Baltimore & Ohio pass which had been issued to him. The book was No. 13 and the editor regarded the number as unlucky. A new book numbered 823 was issued to him. As the total of the figures 8, 2, 3 is 13, it is expected that he will return the second book if this fact is noticed.—*Baltimore Sun*

New Professorships at Columbia College.

Two new professorships have been created at Columbia College in the School of Mines. One of these is Civil Engineering, which takes the place of the chair of Engineering heretofore occupied by Professor Trowbridge. Prof. W. H. Burr has been appointed to his chair. The professorship of Mechanics has also been established and Prof. R. S. Woodward appointed. Professor Woodward is now connected with the United States Coast Survey. He is a graduate of the University of Michigan with the class of 1873, and has distinguished himself in various ways as a mathematician and scientist.

Blackening of Incandescent Lamp Bulbs.

Some time ago the theory was advanced in this country that the blackening of the glass bulbs of electric incandescent lamps was due to the pressure of mercury which in some way came from the mercury pumps used in exhausting the air from the bulbs. The pressure of such mercury vapor, however, according to M. A. Bainville, in the *Revue Industrielle*, affords an altogether insufficient, if not improbable, reason for the observed phenomenon. He offers a different and very simple explanation. The lamp bulbs, as placed on the market, he maintains, contain a certain amount of oxygen, due either to the imperfect vacuum in the bulbs, or the pressure of water vapor, or coming possibly from the lamp filament itself. This occluded oxygen combines with some of the carbon of the filament, forming carbonic oxide, and this gas coming in contact with the relatively cool surfaces of the glass bulb undergoes dissociation, the carbon being deposited on the glass and the oxygen being set free to again combine with new carbon molecules of the filament. This operation, he argues, goes on constantly while the lamp is burning. The blackening process is most vigorous during the early life of a lamp, since at that time the condensing surfaces of the glass bulb are most efficient. After the first deposit of carbon, the operation goes on more slowly.

A New Use for Railroads.

Sir Arthur Sullivan says there is no place for musical inspirations like a railroad car. There is something in the rapidity of the motion, in the clanging of the iron and in the whirring of the wheels which seems to excite his imagination and supplies materials for a host of harmonies.

Argentine Railroads.

A correspondent calls our attention to the paragraph appearing in our issue of Dec. 23 last, referring in an uncomplimentary manner to the management of the Argentine railroads. He points out that the construction of the lines was paid for in gold, that during the last three years gold has been at a premium sometimes of over 300 per cent., and that the revenue has been collected in the debased currency, and "only as much has been collected as the state of depression would admit," freighters having no money; and that, as the dividends are paid in gold in London, the profit percentages of two-fourths, one sixth and one-third may imply as high a rate actually as seven, five and four per cent., if not more, and that this has been earned in face of the disturbances of a bloody revolution.

The Railroad of the Future.

The relations between track and rolling stock formed one of the several topics for discussion presented at the recent international railroad congress at St. Petersburg. The chief contribution to the subject was made by Mr. Wilhelm Ast, of the Kaiser Ferdinand Northern Railroad, of Austria, who, after analyzing at some length the various operating conditions, arrived at the conclusion that on the principal railroads the roadbed and track construction was about up to the maximum traffic requirements, but that there was little, if any, surplus of resistance to meet still further increased demands. To provide such a surplus, Mr. Ast suggested the desirability of giving greater flange width to the rails, the more extensive use of properly designed tie-plates, broader rail-heads, a maximum length of rail, and improved forms of rail joints. The last he considered particularly important, as the rail joints at present, he thought, were the weakest points of the track system. For the cross-ties he recommended greater length and a cross section designed to give greater stiffness. He was in favor also of properly dimensioned metal ties.

The Greatest Year in Iron Ore.

The Lake Superior iron mining region has done the unexpected in the year just closed. It has shipped more ore than in any other year of its history. The total, as made up from exact figures to this paper from every mine except one, and that a small shipper, whose output is closely approximated, is 9,074,243 gross tons for the calendar year 1892. In other words the record of the "big year" 1890 has been exceeded by 70,542 gross tons. Next to the fact of breaking the record, the noteworthy thing about the returns for 1892 is that for the first time since iron ore was mined in the Lake Superior region, the shipments from the Marquette range drop to second place, yielding the lead to the younger Gogebic. How long it will be before the Gogebic yields the palm to the infant Mesaba is a question that will naturally be asked. Certainly not this year, nor the next, we are safe in saying. The probabilities are that the record of 1892 will be exceeded in the year just entered upon—a year that promises some radical and interesting developments on the line of costs; a year that will show which are the fittest producers, that are to survive the battle for cheapest ores.—*Iron Trade Review.*

Gong Signals in German Stations.

According to the new signaling regulations which went into effect on German railroads on Jan. 1, the gong signals hitherto customary are no longer used to announce the departure of trains from stations. It was found some time ago in some of the larger stations on the Prussian state railroads, where several trains start simultaneously, that these gong signals gave rise to considerable confusion, and their use was abandoned at the time, an example being thus set which will henceforth be generally followed on the various German lines.

Electric Railroad Projects.

The Peekskill Surface Railroad Co., capital $50,000, has appliad for a franchise to construct and operate an electric road in Peekskill, N. Y. The intention is to build a line from the railroad station up through the city, and also out to Verplanck's Point, to Hillside Cemetery, to Lake Mohegan, and to the State Camp of Military Instruction. The road is be running by the time the state camp season opens in June.

Grain Elevator Burned at St. Louis.

Elevator "C," of the Carondelet Elevator and Grain Company, at Carondelet (St. Louis), was destroyed by fire on Jan. 22, together with about 1,250,000 bushels of wheat. The total loss is about $1,500,000. The elevator was built in 1879, had a capacity of 2,500,000 bushels, and was owned by the Missouri Pacific Railway.

Collision in Russia.

A St. Petersburg dispatch of Jan. 25 states that a passenger train on the railroad from Wilna to Minsk ran into a freight train that had been stopped by a heavy snowbank. Fifteen persons were killed and 30 seriously injured.

CAR BUILDING.

The Flint & Pere Marquette is having built two handsome drawing-room cars at the works of Barney & Smith at Dayton, O., costing $10,000 each.

BRIDGE BUILDING.

Chester County, Pa.—New iron bridges have been completed over Valley Creek, near Johnson's Crossing, and over Big Elk Creek, near Lincoln University, in Chester County, Pa. Both are 55-ft. spans.

Cleveland, O.—The department of public works is preparing plans for rebuilding Petrie street bridge. The new structure will probably be of iron and will cost $100,000. It is proposed to build it next spring.

Harrisburg, Pa.—On Jan. 19 the distance was measured across the Susquehanna River on the ice for a proposed public bridge to connect West Fairview with this city, at McClay street. There are to be 28 spans of 150 ft. each. An application for a charter will shortly be made, and as soon as secured work on the abutment and piers will begin.

Millington, N. J.—The Delaware, Lackawanna & Western is building a new steel truss bridge across the Passaic River at Millington, N. J., on the Passaic & Delaware branch.

Philadelphia.—The proposed new double-decked bridge to replace the present wooden structure across Schuylkill River at the Falls will not be built this summer, owing to the failure of the City Councils to make the necessary appropriations.

MEETINGS AND ANNOUNCEMENTS.

Dividends.

Dividends on the capital stocks of railroad companies have been declared as follows:

Buffalo, Rochester & Pittsburgh, quarterly, 1¼ per cent, on the preferred stock, payable Feb. 15.

Illinois Central, semi-annual, 2½ per cent., payable March 1.

New York, Chicago & St. Louis, annual, 3 per cent., on the preferred stock, March 1.

Stockholders' Meetings.

Meetings of the stockholders of railroad companies will be held as follows:

Atchison, Topeka & Santa Fe, special, Topeka, Kan., Jan. 31.

Detroit Union Railroad & Station Co., annual, Detroit, Mich., Feb. 1.

New York, New Haven & Hartford, adjourned, New Haven, Conn., Jan. 31, to act upon the lease of the Providence & Worcester.

Philadelphia & Erie, annual, Philadelphia, Pa., Feb. 13.

Texas, Sabine Valley & Northwestern, special, Longview, Tex., Feb. 13, to increase the capital stock.

Wheeling & Lake Erie, annual, Toledo, O., Feb. 14.

Technical Meetings.

Meetings and conventions of railroad associations and technical societies will be held as follows:

The *New England Railroad Club* holds regular meetings at the United States Hotel, Beach street, Boston, Mass., on the second Wednesday of each alternate month, commencing January.

The *Western Railway Club* holds regular meetings on the third Tuesday in each month, except June, July and August, at the rooms of the Central Traffic Association in the Rookery Building, Chicago, at 2 p. m.

The *New York Railroad Club* holds regular meetings on the third Thursday in each month, at 7:30 p. m., at the rooms of the American Society of Mechanical Engineers, 12 West Thirty-first street, New York City, N. Y.

The *Central Railway Club* meets at the Hotel Iroquois, Buffalo, the fourth Wednesday of January, March, May, September and November.

The *Northwest Railroad Club* meets on the first Saturday of each month, except June, July and August, in the St. Paul Union Station, at 7:30 p. m.

The *Northwestern Track and Bridge Association* meets on the Friday following the second Wednesday of March, June, September and December, at 2:30 p. m. in the directors' room of the St. Paul Union Station.

The *American Society of Civil Engineers* holds its regular meetings on the first and third Wednesday in each month, at the House of the Society, 127 East Twenty-third street, New York.

The *Boston Society of Civil Engineers* holds its regular meetings at Wesleyan Hall, Bromfield street, Boston, at 7:30 p. m., on the third Wednesday in each month.

The *Western Society of Engineers* holds its regular meetings at 78 La Salle street, Chicago, at 8 p. m., on the first Wednesday in each month.

The *Engineers' Club of St. Louis* holds regular meetings in the club's room, Laclede Building, corner Fourth and Olive streets, St. Louis, on the first and third Wednesday in each month.

The *Engineers' Club of Philadelphia* holds regular meetings at the House of the Club, 1,122 Girard street, Philadelphia, on the first and third Saturday of each month. The annual meeting is held on the third Saturday in January.

The *Engineers' Society of Western Pennsylvania* holds regular meetings on the third Tuesday in each month, at 7:30 p. m., at its rooms in the Thaw Mansion, Fifth street, Pittsburgh, Pa.

The *Engineers' Club of Cincinnati* holds its regular meetings at 8 p. m. on the third Thursday of each month in the rooms of the Literary Club, No. 24 West Fourth street, Cincinnati.

The *Civil Engineers' Club of Cleveland* holds regular meetings on the second Tuesday of each month, at 8 p. m., in the Case Library Building, Cleveland. Semi-monthly meetings are held on the fourth Tuesday of the month.

The *Engineers' Club of Kansas City* meets in Room 200, Baird Building, Kansas City, Mo., on the second Monday in each month.

The *Engineering Association of the South* holds its monthly meetings on the second Thursday at 8 p. m. The Association headquarters are at Nos. 63 and 64 Baxter Court, Nashville, Tenn.

The *Denver Society of Civil Engineers and Architects* holds regular meetings at 36 Jacobson Block, Denver, Col., on the second and fourth Tuesday of each month, at 8 o'clock p. m., except during June, July and August, when they are held on the second Tuesday only.

The *Civil Engineers' Society of St. Paul* meets at St. Paul, Minn., on the first Monday in each month.

The *Montana Society of Civil Engineers* meets at Helena, Mont., at 7:30 p. m., on the third Saturday in each month.

The *Civil Engineers' Association of Kansas* holds regular meetings at Wichita on the second Wednesday of each month at 7:30 p. m.

The *American Society of Swedish Engineers* holds meetings at the club house, 250 Union street, Brooklyn, N. Y., and at 347 North Ninth street, Philadelphia, on the first Saturday of each month.

The *Engineers' Club of Minneapolis* meets the first Thursday of each month in the Public Library Building, Minneapolis, Minn.

The *Canadian Society of Civil Engineers* holds regular meetings at its rooms, 112 Mansfield street, Montreal, P. Que., every alternate Thursday except during the months of June, July, August and September.

The *Association of Civil Engineers of Dallas* meets at 803 Commerce street, Dallas, Tex., on the first Friday of each month at 4 o'clock p. m.

The *Technical Society of the Pacific Coast* holds regular meetings at its rooms in the Academy of Sciences Building, 819 Market street, San Francisco, Cal., at 8 o'clock p. m. on the first Friday of each month.

The *Tacoma Society of Civil Engineers and Architects* holds regular meetings on the third Friday of each month, in its rooms, 201 and 202 Washington Building, Tacoma, Wash.

The *Association of Engineers of Virginia* holds regular meetings at Roanoke, on the second Saturday in each month, at 8 p. m., except the months of July and August.

The *Engineers' and Architects' Club of Louisville* holds regular meetings on the second Thursday of each month, at 8 o'clock p. m., at its rooms in the Norton Building, Louisville, Ky.

Engineers' Club of St. Louis.

The Club met Jan. 18, 1893, at the club rooms, President Moore in the chair; and 26 members and three visitors present. Mr. Geo. H. Pegram then presented the paper of the evening on "The Bridge Across the Arkansas River at Fort Smith." A full description of the construction of the bridge was given. The piers were built of concrete, using Portland cement, and the method of erection was shown and illustrated with drawings. The specifications were read and the tests of materials used were presented in tables. The iron work was described and full drawings showed the design and calculations. Discussion followed by Messrs. Schaub, Ockerson, Seddon, Moore, Johnson, Pegram, Gayler and Russell.

Freight Claim Association.

The Freight Claim Association will hold its regular semi-annual meeting in St. Louis, Mo., on Wednesday, March 8, 1893, the headquarters of the members being the Southern Hotel. S. A Mehorter, Philadelphia, is Secretary.

General Baggage Agents.

The semi-annual convention of the American Association of General Baggage Agents met in Chicago Jan. 18, 19 and 20. The election of officers for the year resulted as follows: President, H. A. Winters, Illinois Central; Vice-President, S. A. Smart, Great Northern; Secretary, J. E. Quick, Chicago & Grand Trunk: Executive Committee, George S. Cantlie, Canadian Pacific; S. D. Greenwalt, Central of New Jersey; J. P. Browning, Louisville & Nashville.

New England General Freight Agents.

The annual meeting of the Association of General Freight Agents of New England was held at Boston, Jan. 19. Officers for the ensuing year were elected as follows:

President, J. A. Southard, of New London, Conn.; Vice-President, D. C. Prescott, of Concord, N. H.; Secretary-Treasurer, Paul Wadsworth, of Albany, N. Y.

Appropriate resolutions were adopted on the death of S. C. Putnam, General Freight Agent of the Old Colony.

PERSONAL.

—Mr. Orville Van Vlect, Master Mechanic of the Chautauqua Lake road, died at his home in Jamestown, N. Y., Jan. 18, aged 42 years.

—Mr. A. J. Rauh, Treasurer and Assistant Secretary of the Richmond & West Point Terminal Co., died of consumption at Las Vegas, New Mexico, last Monday, Jan. 23.

—Mr. C. F. Lape, Division Master Mechanic of the Wabash, has been appointed Railroad Commissioner of Illinois by Governor Altgeld.

—Governor Flower, of New York, has reappointed Michael Rickard, of Utica, to be State Railroad Commissioner for a term of five years, with an annual salary of $8,000.

—Mr. Simeon R. Billings, of Genesee, Mich., has been appointed State Railroad Commissioner of Michigan by Governor Rich. Governor Rich was himself Railroad Commissioner of Michigan in 1889 and 1890.

—Mr. C. H. Goodrich, who has just resigned as Assistant General Freight Agent of the New York & New

England, will, it is said, accept a similar position with the Philadelphia & Reading.

—Mr. E. H. Beckler, of Helena, Mont., has resigned the positions of Chief Engineer of the Pacific extension of the Great Northern Railroad, the Seattle & Montana, and the Montana Central roads, the resignation taking effect Jan. 18. The construction work on these lines is now about completed.

—Mr. William Stevenson, General Superintendent of the Northern Division of the Philadelphia & Reading, reached Buffalo last week after a three-months trip through the West, having gone as far as the Pacific Coast. Mr. Stevenson is on leave of absence, and, although much improved in health, says he has not decided when he will again return to active work.

—The directors of the Boston & Maine have chosen Mr. W. K. Niver, late of the Philadelphia & Reading, as Vice-President of the road. Mr. Niver was formerly local agent at Buffalo, N. Y., for the Philadelphia & Reading Coal & Iron Co., but has lately been Acting General Northern Superintendent of the railroad during the absence on leave of absence of Mr. William Stevenson.

—President J. J. Hill, of the Great Northern, arrived at Seattle, Wash., Jan. 23, accompanied by a party of railroad officers and friends who had made the trip over the new Pacific extension from St. Paul. The party includes Samuel Hill, President of the St. Paul, Minneapolis & Manitoba; Chief Engineer N. D. Miller, of St. Paul; C. H. Nichols, of New York City, Secretary of the Great Northern, and a number of other officers.

—Prof. William H. Burr has been appointed Professor of Civil Engineering in the School of Mines at Columbia College. This is a new professorship and takes the place of the Professorship of Engineering which was held by Professor Trowbridge at the time of his death. Professsr Burr, it will be remembered, went quite recently to the Lawrence Scientific School at Harvard University at the head of the Department of Engineering.

—Judge Ira B. Mills has been appointed a member of the Railroad and Warehouse Commission of Minnesota, vice Judge Williams, whose term has expired. Judge Mills is a graduate of the Law School at Albany, N. Y., and has been a resident of Minnesota for the past 13 years. For the last six he has presided as judge of the Fourteenth Judicial District. Judge Mills is an eminent jurist and will be a valuable member of the Commission.

—Mr. H. A. Gillis, Division Master Mechanic of the Erie at Port Jervis, has resigned to become Superintendent of the Roanoke Locomotive and Machine Works at Roanoke, Va. Mr. Gillis is an able and resolute man and deserves the gratitude of the Erie for the stand that he has taken in the matter of drinking among his men at Port Jervis. He has incurred the bitter hostility of the so-called liquor interest of at least two states, but he has upheld discipline and morality with admirable courage.

—The vacancy caused by the resignation of Mr. Theodore Voorhees, General Superintendent of the New York Central, has been filled by the appointment of Mr. Edgar Van Etten. Mr. Van Etten entered the railroad service in 1864, and after serving in subordinate capacities on the Erie road he became Superintendent of the Delaware Division in 1884, and of the Western Division in 1887. In 1889 he was appointed Superintendent of the Western Division of the Rome, Watertown & Ogdensburg Railroad, and the following year was made manager of the Car Service Association at Buffalo. For a short time in 1892 Mr. Van Etten was Superintendent of the Buffalo Division of the Lehigh Valley, but for nearly a year he has been Superintendent of the Rome, Watertown & Ogdensburg road. Mr. Van Etten will succeed Mr. Voorhees on Feb. 1.

—Mr. Theodore Voorhees, General Superintendent of the New York Central & Hudson Railroad Company, has resigned to accept the First Vice-Presidency of the Philadelphia & Reading. His resignation takes effect Feb. 1, and he will assume his new duties on that day. Mr. Voorhees is still a young man, in the very prime of his working life, and it is to be hoped that he will find the opportunity to win distinction in his new position. He has been General Superintendent of the New York Central about three years, having before that been Assistant General Superintendent since 1885. Before going to the New York Central he was Superintendent on the Delaware & Hudson Canal Company's road for 11 years. Mr. Voorhees is a member of the American Society of Civil Engineers and was elected a Director of that body in January, 1890. Besides his wide professional acquaintance and reputation he has within a few years become well known to the general public by his contributions to the magazines, being a ready and interesting writer.

ELECTIONS AND APPOINTMENTS.

Baltimore & Harrisburg.—At the annual meeting at Hanover, Pa., last week the following were elected: President, Capt. A. W. Eichelberger, of Hanover; Directors, J. M. Hood, W. S. Rayner, C. W. Slagle, David Wills, Reuben Young, L. P. Brockley, Jerome L. Boyer, W. H. Vickery, H. E. Young and R. M. Wirt. R. M. Wirt was re-elected Secretary, and Geo. H. Baer, of Baltimore, Treasurer.

Berlin Branch.—At the annual meeting and election of officers held at Abbottstown, Pa., Jan. 9, the following were elected: President, Capt. A. W. Eichelberger, of Hanover, Pa.; Secretary, Michael Rebert; Treasurer, Jacob Resser; and Directors, Prof. Daniel Eberly, Jacob Resser, Stephen Keefer, H. A. Young, Dr. R. N. Meisenhelder, Wm. Hildebrand, Michael Rebert, W. G. Leas and Joseph Wolf.

Brockville, Westport & Sault Ste. Marie.—The annual meeting was held at Brockville, Ont., Jan. 20. Officers were elected as follows: President, Henry M. Hoyt, Jr, Philadelphia, Pa.; Vice-President, W. H. Cole, Brockville; General Manager, Samuel Hunt, Cincinnati, O. Directors: H. M. Hoyt, Jr, Col. Cole S. Hunt, D. W Downey, R. Bowie, D. Derbyshire, W. T. Parish, P. H. Weatherhead, John Winey, Geo. R. Webster, W. C. Fredenburg and James Mooney.

Central Vermont.—H. M. Fisher has been appointed Freight Claim Agent, with headquarters at St. Albans, Vt., vice S. Macdonald, resigned to accept other service.

Chicago & Eastern Illinois.—Robert Spencer having resigned as Purchasing Agent to accept service with another company the following official changes will be made: Charles H. Rockwell has been appointed Assistant to the President and will have charge of the Purchasing Department; E. P. Broughton has been appointed General Superintendent in charge of the Operating Department, vice Charles H. Rockwell, promoted.

Chicago & Indiana State Line.—The stockholders held their annual election last week at Chicago. John Newell and John B. Sherman were elected directors for three years. The election of officers resulted as follows: N. Thayer, Boston, President; John B. Sherman, Chicago, Vice-President and General Manager; George T. Williams, Chicago, Secretary and Treasurer; J. C. Denison, Chicago, Assistant Secretary and Treasurer; James H. Ashby, Chicago, General Superintendent.

Cumberland Valley & Martinsburg.—At the annual meeting held in Martinsburg, W. Va., Jan. 24, these directors were elected: Thomas B. Kennedy, J. F. Boyd and John Stewart, of Chambersburg, Pa.; E. B. Faulkner, M. T. Ingles, G. M. Bowers and W. T. Stewart, of Martinsburg; Messrs. Baker, Cooper, Gorman, Smith, Holmes, Conrad, James B. Russell and R. W. Stone, of Winchester, Va. Subsequently the Board was organized by the election of Hon. Thomas B. Kennedy as President; M. T. Ingles as Secretary, and J. B. Russell as Treasurer.

Dunkirk, Allegheny Valley & Pittsburgh.—D. C. Moon has been appointed Assistant Superintendent, and C. G. Thayer General Freight Agent with headquarters at Dunkirk, N. Y.

Ebensburg & Black Lick.—The incorporators are Henry P. Welch, and R. D. Barclay, John P. Green and George Wood, Philadelphia; William A. Patton, Radnor; Samuel Rea, Bryn Mawr, and Samuel Shortlege, Wynnwood, Pa.

Excelsior Springs.—The following officers have been elected by this Missouri company: S. F. Scott, President and General Manager, Kansas City, Mo.; H. M. Holden, Vice-President, Kansas City; H. E. Robinson, Treasurer, St. Louis; W. A. Butterfield, Secretary, Excelsior Springs, Mo., and F. S. Mitchell, Chief Engineer, St. Louis.

Fonda, Johnstown & Gloversville.—The new directors have elected the following officers: President, H. Walter Webb, New York; Vice-President, William Littauer; Secretary, Henry Sprague, 1145 Broadway, New York City; Treasurer, John Carstensen.

Great Salt Lake & Hot Springs.—At the annual meeting at Salt Lake City, last week, the directors elected were: Clement Bougardier, O. J. Salisbury, J. J. Daly, J. L. Rawlins, James F. Woodman, David Stoker and Josiah Barnett. Messrs. Barnett, Woodman and Stoker were re elected from the old board. The retiring members are Superintendent Bamberger and Messrs. Beck, McCartney and Smith.

Lake Street Elevated (Chicago).—The annual meeting of the newly organized Lake Street Elevated company was held in Chicago, Jan. 24, and officers elected. The following directors were elected: John A. Roche, John H. Witbeck and Gilbert B. Shaw, Chicago; Charles H. Deere, Moline, Ill.; William Zeigler and John F. Moffatt New York; Clarence A. Knight, Chicago; Daniel W. Campbell, Kansas City; and Hiram P. Thompson, Chicago. The new directors elected the following officers: President, John A. Roche; Vice-President, Hiram P. Thompson; Treasurer, John H. Witbeck; Secretary, O. W. Bruner.

Louisville, New Albany & Chicago.—G. K. Lovell has been appointed Assistant General Superintendent.

Lufkin, South & Southwestern.—The following officers have been elected: E. J. Mantooth, President; S. W. Henderson, Vice-President; S. Wiener, Auditor; B. F. Bonner, Secretary-Treasurer, and J. H. Kurth, General Manager. Directors, W. H. Bonner, J. H. Kurth, A. M. Denman, S. W. Henderson, B. F. Bonner, J. J. Bonner and E. J. Mantooth. The headquarters are at Lufkin, Tex.

Mexican National.—V. R. Dwinell has been appointed Superintendent of the Southern Division, vice E. N. Brown, promoted.

New York & New England.—H. A. Hodge, formerly of the Fitchburg, but recently General Freight Agent of the Rome, Watertown & Ogdensburg road, has been appointed General Freight Agent of this road. The place has been vacant since Mr. Randolph's retirement. C. F. Goodrich, Assistant General Freight Agent, who was temporarily in charge, has resigned.

New York, Ontario & Western.—General Manager J. E. Childs, under date of Jan. 20, announces the resignation of C. W. Laupher as Superintendent of Transportation, to engage in other business. The office of Superintendent of Transportation has been abolished and that of General Superintendent created. J. P. Bradfield has been appointed to the new position, as already announced. His headquarters will be at Middletown, N. Y., and he will have entire charge of the Transportation Department.

Pennsylvania Co.—H. R. Dering, Assistant General Passenger Agent of the Pennsylvania lines at Cincinnati, is to be transferred to Chicago to take the place of Assistant General Passenger Agent J. H. Luce, who has retired on account of ill health.

Terre Haute & Peoria.—The stockholders have elected three directors for two years, as follows: William R. McKeen and John G. Williams, of Terre Haute, and J. W. Burgoon, of Decatur, Ill. The directors elected these officers: President, W. R. McKeen; Vice-President, John G. Williams; Secretary and Treasurer, George E. Farrington.

Wabash.—S. W. Jeffery, Chief Clerk in the motive power department, has been appointed Master Mechanic at Springfield, Ill., to succeed C. F. Lape, resigned.

Wagner Palace Car Co.—The following appointments and changes in the operating department are announced: W. B. Harner, District Superintendent, with headquarters at Kansas City, Mo.; George M. Ricketts, Assistant District Superintendent, St. Louis district, vice John W. Van Duyn; R. A. Wilson, Assistant District Superintendent, Michigan Central district, Chicago, vice George M. Ricketts; C. C. Hughes, Assistant District Superintendent, New York Central district, vice I. S. Kelly; H. M. Hamilton, Assistant District Superintendent, Buffalo district, vice G. D. Morrison; I. H. Davidson, Assistant District Superintendent, Boston district, vice H. M. Hamilton.

Washington & Columbia River.—J. G. Cutler has been appointed Chief Engineer of this company, with office at Walla Walla, Wash., vice C. E. Sears, resigned.

West Shore.—The appointment of C. H. Ketcham as Division Superintendent in charge of the Buffalo Division was announced on Jan. 25. His headquarters will be at Syracuse, N.Y. Mr. Ketcham will continue as Superintendent of the Dunkirk, Allegheny Valley and Pittsburgh road. As division Superintendent of the West Shore he succeeds J. P. Bradfield, resigned to accept service with the New York, Ontario & Western.

RAILROAD CONSTRUCTION.

Incorporations, Surveys, Etc.

Bangor & Aroostook.—About 500 men are still at work on this road despite the cold weather. The grading is completed ready for the rails from the Southern terminus at Brownville Junction, Me., for 5½ miles. The heavy masonry work at the Canadian Pacific crossing at Millbrook is complete, ready for the iron superstructure. On the Northern end of the line the grading has been done from Stacyville to a point 2½ miles above Houlton, Me., the whole distance being 40 miles. Of this distance 30 miles of grading is complete, and it includes the heaviest work on the whole line. At Limestone Brook is a fill of 34 ft. in depth, requiring 20,000 yards of earth. Before reaching that point a cut was made through the divide between the Penobscot and St. John waters. The cut is 400 ft. long and from 12 to 18 ft. deep, most of which is a solid ledge. At Moulton a heavy cut, 60 ft. deep, has been made. About 30,000 yards of earth were removed. North of Houlton the right of way through to Caribou, the northern terminus, has been cleared; also on most of the Fort Fairfield branch. Thus far between $300,000 and $400,000 have been expended. This includes the cost of the surveys and the right of way expenses, besides what has been paid for grading, etc. The Aroostook County Commissioners have accepted two five-mile sections of the road and paid the company $20,000 a section as agreed upon. The grades thus far do not exceed 63.8 ft. to the mile. It is the intention to complete the road this year, and there is little doubt that it will be done. The work will be pushed more rapidly in the spring, and especially between Brownville and the Aroostook County line. The road will have a tangent 12 miles long, in Stacyville, Sherman and Crystal.

Beech Creek.—The extension to Mehaffey, Pa., and to the connection with the Cambria & Clearfield is almost completed. The work on the two tunnels has been finished and the bridge at Clearfield is nearly ready for traffic. The extension is 12 miles long, extending from Keermoor on the present line west to Mehaffey, Pa., and to large coal fields at Patton, the trains of the company running over 12 miles of the Cambria & Clearfield under a traffic contract which makes the road between Mehaffey and Patton practically a joint line.

Boulte & Hahnville.—This company lately incorporated in Louisiana, is building about five miles of narrow gage road near Hahnville, La. Chas. E. Rice J. A. Morris and Thos. Sully are incorporators.

Burlington, Cedar Rapids & Northern.—The construction work on the line west of Forest City, Ia., is now completed, and the road is being operated to Armstrong, in Emmet County, Iowa, a distance of 45½ miles from Forest City. The present terminus of the road is about 20 miles east of Estherville on the Iowa Falls Division, and although surveys have been made to that point, there is no present intention of extending the line. The track was laid into Armstrong on Dec. 24, all the grading and tracklaying on the new line having been completed in 1892.

Catskill & Tannersville.—Messrs. Mairo & Lewis, of 18 Broadway, New York, who have been awarded the contract for building the road to Kaaterskill Station, N. Y., about 1½ miles, are to complete the work by April. The line is to extend from Catskill Mountain Station, the summit of the Otis Elevating road, to Kaaterskill Station, N. Y. Surveys have been made to Tannersville, N. Y. C. L. Rickerson, 54 Harrison street, New York City, is President.

Cleveland Belt Line.—This road has been practically completed between the Cleveland, Canton & Southern Railroad and the yards of the Cleveland, Cincinnati, Chicago & St. Louis at Linndale, and will be opened for traffic on Feb. 1. The work between Linndale and Rockport, the western terminus, is being pushed, and will be completed very soon. It is hoped by the officials to have the whole road in working order, from Rockport to Collinwood, next summer.

Duluth & Iron Range.—The engineers are still in the field completing the location of the new line to the Mesaba iron range in Northern Minnesota. It is expected that they will complete their work this week.

Duluth, Mesaba & Northern.—Contracts for grading the line from Oneota to a point six miles north of Stony Brook Junction, Minn., have already been awarded. Wolf & Co., of Duluth, have the first four and last 10 miles, and Guldbrantson & Son, of Duluth, have the middle section of 12 miles. Morris & Shipley, of Faribault, Minn., have the contract for wooden bridges and the Youngstown Bridge Co., of Youngstown, O., that for the viaduct leading to the ore docks at Oneota.

Ebensburg & Black Lick.—This company was incorporated Jan. 18, 1893, at Harrisburg, Pa. The line is to be built from a connection with the Cambria & Clearfield road between Kaylors and Ebensburg, Pa., thence via the valley of Black Lick to a connection with the Indiana branch of the Pennsylvania road near Black Lick station, in Indiana County, a distance of 35 miles. The capital stock is $500,000. Henry D. Welsh, Philadelphia, is President, and the directors are officers of the Pennsylvania.

Excelsior Springs.—W. B. Strang, Kansas City, is the contractor for building the first 10 miles of this road, which was recently chartered in Missouri. The line now being built is from Excelsior Springs, Mo., on the Chicago, Milwaukee & St. Paul to Cooley's Lake on the Wabash, 10 miles, and so far 1½ miles of track has been built. The trains will probably be running on the 10 miles by April 15. The financial arrangements for building and equipping this portion of the line have been completed. An extension to St. Joseph, Mo., a distance of 52 miles, is contemplated, and the preliminary surveys for this line will be started early in February. S. F. Scott, Kansas City, Mo., is President and General Manager and F. S. Mitchell, of St. Louis, is Chief Engineer.

Gadsden Coal and Iron Railroad.—A bill to incorporate this company is before the Alabama legislature. The incorporators are T. T. Hillman, George L. Morris and James A. Stratton, of Birmingham, and the capital

is $100,000. The chief office is to be at Gadsden, Ala. The route of the proposed road is not given.

Granite Hill.—The incorporation of this company in Penusylvania was recently noted, but the line is already built from a connection with the Baltimore & Harrisburg at Granite Station, in Adams County, Pa., about one mile to a granite quarry owned by a Baltimore company. The charter was secured to complete the organization under the general railroad laws of the state. David Wells is President and W. B. Quimby Secretary, both of Gettysburg, Pa. T. Barton Jones, 221 North Gay street, Baltimore, is Treasurer.

Great Northern.—Press dispatches from Seattle state that President Hill, who is now on the Pacific Coast, has announced that through freight trains will begin running over the Pacific extension from St. Paul to Seattle by Feb. 1, and that the first through passen ger train will probably be run early in April. It is said that the passenger trains will make the run to the coast in 80 hours from St. Paul.

Indiana, Illinois & Iowa.—A special meeting of the stockholders has been called for March 3 at Fairbury, Ill., to consider a proposition to issue $500,000 of new 50 per cent. bonds. The funds secured by the sale of bonds, will, it is understood, be used in building the branch from Kankakee northwest to South Bend, Ind., a distance of 20 miles.

Jellico & Bird Eye.—The Jellico & Bird Eye Coal Company, of which E. T. Halsey, of Louisville, is President, built this road last year from Jellico, Ky., to the Bird Eye coal mines in Whitley County, Ky. The grading is about completed for eight miles, and the rails will be laid as soon as the weather permits.

Kansas City, Nevada & Ft. Smith.—The tracklaying on the southern extension will be resumed in a few days, or as soon as the weather will permit. This extension has been completed for about 18 miles south of Hume, Mo., to the junction of the Missouri, Kansas & Texas, near Clayton, the track having been laid on this portion of the line, about 18 miles, before Jan. 1. The road bed has been graded south from Clayton a distance of about 30 miles toward Pittsburgh, Kan., which is the proposed terminus. Richard Gentry, of Kansas City, is General Manager.

La Fayette.—F. C. Cole, of La Fayette, Tex., is Engineer in charge of the road being built from La Fayette to Cannon Switch, La.

La Porte, Houston & Northern.—General Manager T. W. Lee is said to have purchased the rails and equipment for this line during his recent visit to New York. The line is now graded and bridges built from La Porte, on Trinity Bay, northwest to Harrisburg, near Houston, Tex., 16 miles, and will be ready for the track as soon as the rails are delivered.

Laurel River & Hot Springs.—The work on this road in North Carolina has been delayed by the recent severe weather, and at present only about 60 men are employed. Three miles of the road has been graded from Hot Springs, N. C. The route is from Hot Springs, up Tan Yard branch, through the Gahagan Gap, down the Little Hurricane Creek, to the Laurel River, and up Laurel River to the mouth of the Foster Creek, 25 miles in all. The line has been located for 10 miles, and preliminary surveys made to Foster Creek. The company is doing all the work without subletting to contractors. There is only one iron bridge, which is already built, and several trestles, the heaviest one being finished. Nearly all the stock is held in Lynn, Mass. The company will resume active work shortly. Cross ties are being delivered daily. H. M. Ramslur is Chief Engineer.

Lufkin, South & Southeastern.—The organization of this company recently chartered in Texas has been completed, and E. J. Mantooth elected President, and B. F. Bonner, of Lufkin, Tex., Secretary. It is proposed to build the line from Lufkin in Angelina County on the St. Louis Southwestern southeast to Rockland in Tyler County, a distance of 30 miles. Rockland is the northern terminus of a branch of the Southern Pacific which has its southern terminns at Sabine Pass, and the proposed line will practically complete a route from the Gulf of Mexico through Eastern Texas to Texarkana.

Mexico, Cuernavaca & Pacific.—The location is now completed from the City of Mexico to Cuernavaca, Mex. All the material necessary to build to Contreras has been delivered in Mexico. The equipment consists, at present of 100 freight cars, 24 passenger cars and express cars, four cabooses and two engines.

Natchez & Pascagoula.—This road, which recently filed a charter in Mississippi, is only intended to be, for the present at least, a dummy line, to connect the towns of Moss Point, Scranton and Pascagoula Bay, on the Southern coast of Mississippi. The incorporators are: Frederick W. Flint, Mt. Airy, Habersham County, Ga., and George G. Bradshaw, New Orleans, La.

New Roads.—A meeting of the promoters of a new road, to run between Medford and Long Beach, Beach Haven and Arlington Beach, N. J., was held this week at the office of John F. Harned, Camden. It is stated that the right of way has already been partly secured.

Northern Arkansas.—This company was incorporated at Little Rock, Jan. 19. P. Arlund is President; R. D. Welch, Vice-President and General Manager; G. C. Buford, Secretary, and H. G. King, Treasurer. The proposed road is to commence at Ravenden Station, Lawrence County, on the Kansas City, Fort Scott & Memphis road, to the town of Ravenden Springs, Randolph County. The principal office will be at Mammoth Springs.

Pennsylvania Co.—Surveys were begun this week by Charles Minch, of Massillon, O., Division Engineer, for a second track between Massillon and Orrville, O., 14 miles on the Fort Wayne division. The line will probably be double tracked from Pittsburgh to Massillon by March 1.

Perry County.—The tracklaying on the extension from New Bloomfield, Pa., finally reached Landisburg, Pa., last week, the construction work having been considerably delayed by the extreme cold weather. This new line is 12 miles long and extends from New Bloomfield southwest to Landisburg. The branch was nearly all graded in the early part of the year, but the tracklaying was delayed by litigation with the Newport & Sherman's Valley over a crossing so that the work was not completed until last week.

Pine Bluff & Sulphur Springs.—Articles of incorporation were filed at Little Rock, Ark., Jan. 17. The road is to extend a distance of seven miles from Pine Bluff, Ark., to Sulphur Springs. The capital stock is $50,000. The officers are R. D. Davidson, President; C. E. Philpot, Vice-President; J. H. Humphrey, Secretary; and W. A. Leach, General Manager.

Tehuantepec.—A Mexican paper states that over 3,000 men are now at work on the construction of this line, and that there is only 50 miles of track to be laid, 35 miles of this being already graded.

Texas Central.—A survey was begun last week by W. T. Gould, Resident Engineer of the company, for the new line into Waco, Tex., from the present terminus of the line at Ross. The distance is about 11 miles, and the work will include a new bridge across the Brazos River, near Waco. Trains are now run into Waco over the tracks of the Waco & Northwestern road, which was recently sold at foreclosure sale to E. H. R. Greer, President of the Texas Midland, a company recently organized to operate the former Northwestern division of the Texas Central.

Texarkana & Fort Smith.—A locating survey was begun last week by G. Knoble, Chief Engineer for the proposed extension from Wilton, Ark., the present end of track north to Little River, about 10 miles. It is expected that this section will be built early in the year, and that the line will also be extended north of Little River during 1893. It is stated that President W. L. Whitaker, of Texarkana, and his associates who have had control of the road have sold their interest to a Kansas City syndicate which it is expected, will assume control in February. The new owners are said to be interested in the Kansas City, Nevada & Fort Smith road

Winona, Marshalltown & Southern.—Prominent business men of Marshalltown, Ia., have organized this company and the articles of incorporation were filed in Iowa Jan. 18. It is proposed to extend the Winona & Southwestern from Osage through Marshalltown, Charlton and the coal fields in Southern Iowa. The incorporators are U. S. Ketchum, G. F. Kirby, C. C. Gilman and A. G. Glick.

GENERAL RAILROAD NEWS.

Bradford, Eldred & Cuba.—The sale of the property and franchises in foreclosure took place Jan. 25, at Belmont, Allegheny County, N. Y., under the direction of Hon. D. P. Richardson, Referee. The property was bought by August Stein, of 70 Broadway, New York, in behalf of a syndicate of creditors. The railroad has been operated until recently under the management of Hon. Thomas C. Platt, as Receiver.

Brooklyn, Bath & West End.—This road was sold at foreclosure at Brooklyn, N. Y., on Jan. 17 and was purchased by E. E. Denniston, of the Brooklyn Traction Co. The purchase price is said to have been the par value of the stock, which would be between $500,000 and $600,000. Nearly all the stock was held in Philadelphia, the principal holder being the banker, Jay Cooke. The road starts at the Union Station at Thirty-sixth street and Fifth avenue, Brooklyn, and extends through New Utrecht to Bath Beach and Bensonhurst to Coney Island. Its total mileage of single track is 16⅓ miles. It has never paid dividends. It is proposed to change the motive power from steam to electricity.

Carolina, Knoxville & Western.—The foreclosure sale of this road will occur at Greenville, S. C., on March 8 next, in pursuance of an order of Judge Simonton, of the United States Circuit Court. The road was completed in 1888, about 15 miles from Greenville, northwest to near Marietta, S. C. When work was suspended in that year on account of the failure of the Georgia Construction & Investment Company, which was building the line, a good part of the grading between Augusta and Greenville, S. C., had been completed, and some grading had been done on the line toward Knoxville, Tenn. James T. Williams is Receiver of the construction company and H. C. Beattie, of Greenville, is Receiver of the railroad and will conduct the sale. William Bailey, 29 Broadway, New York City, is President.

Delaware & Otsego.—This road was formally leased to the Ulster & Delaware this week, at the nominal rental of $1. The road is practically an extension of the latter line, from Stamford to Bloomville, N. Y., a distance of 13 miles. The Otsego company also owns the right of way to Oneonta, much of the line having been graded. It is rumored now that this extension will be completed soon.

Duluth & Winnipeg.—The Minneapolis Trust Co. recently began suit against this company to recover the amount of a loan and interest amounting to about $600,000. The officers of the company settled the case by paying all of the loan, interest and costs. Another suit was brought in the District Court of Hennepin County for $21,000 by Foley Brothers & Guthrie, contractors, of St. Paul. It is alleged that this was included in the $600,000 claim of the Minneapolis Trust Company. The directors of the railroad company claim that they are ready to pay any and all just claims against the company. There appears to be a strong effort to ruin the credit of this company, whether to obtain possession of the property or to prevent the extension of the line to the Red River Valley, where it would be a strong competitor of other lines, or for other purposes, is a question. The Duluth & Winnipeg officials state, and their statement is generally believed in the Northwest, that they have arranged for all the money necessary for the extension to the Red River, also of the branch lines needed to reach the wheat fields in that section.

Georgia Southern & Florida.—A petition has been filed in the Superior Court at Macon, Ga., by the Mercantile Trust & Deposit Co., of Baltimore, asking for the removal of Willis B. Sparks as Receiver of this railroad. The Mercantile Trust & Deposit Co. is the trustee of the mortgage bonds and the action looking to the removal of Receiver Sparks was determined upon at a meeting of the committee of bondholders recently held in Baltimore.

Prospect Park & Coney Island.—The purchase of this road by the Long Island Railroad was confirmed Jan. 24 at a meeting of the stockholders of the latter company. The Long Island company guarantees 4½ per cent. on the bonds held by Messrs. Culver and Washington, which represent a majority. The Long Island company also secures a controlling interest in the stock.

San Antonio & Aransas Pass.—The purchase of this road for the Southern Pacific has, it is announced, been closed, and the formal transfer will be made in a few days. The formal steps were delayed at the request of members of the committee representing security holders from whom the purchase was made. Thomas E. Stillman, of New York, will be elected President when the Southern Pacific takes formal possession.

TRAFFIC.

Traffic Notes.

The Kanawha Dispatch will restore west bound freight rates from New York to the Mississippi River to the basis of 72 cents first class.

Large quantities of rough rice have lately been shipped from the Louisiana plantations to Savannah, where the rice is to be milled.

The Mayor of Detroit is asking the mayors of other cities to unite in a demand upon the railroads to grant stop-overs to passengers from the East going to the World's Fair.

A "Freight Shippers' Association" has been incorporated at Philadelphia with a capital of $250,000; amount paid in said to be $10,000. The business of the concern is to be the collection of freight claims, apparently

The National Board of Trade, at its meeting in Washington last week, passed resolutions in favor of the various amendments to the Interstate commerce law which are before Congress and which are mentioned in another column of this paper, and also in favor of laws to compel railroads to pay demurrage on delayed freight and looking to the simplification of bills of lading.

The New York & New England has given notice of a withdrawal from the New York and Boston lines passenger committee. The notice takes effect in 60 days, and is thought to indicate an intention to reduce fares between Boston and New York by the New England road and the Norwich line steamers. The unfriendliness between this road and the New Haven is also brought to notice by the announcement that after Feb. 4 the through night passenger train between Boston and Washington is to run over the Old Colony and the Shore line instead of over the New York & New England via Hartford, which route it has traveled ever since it was put on, about 15 years ago. The New York & New England is not to be suppressed, however, and announces that, beginning Jan. 29, the night Washington express will be run via Poughkeepsie Bridge "on account of the continual delays caused by ice in the lower river and the inconvenience of steamer transfer."

Chicago Traffic Matters.

CHICAGO, Jan. 25, 1893.

The Minneapolis roads have postponed their conference about wheat rates. The Soo line has obeyed the order of the commission and reduced the rate on wheat from Dakota points to Minneapolis, making the required difference between this rate and the rate to Duluth. The other roads will probably not follow this example until after a conference is held. The outcome of the matter will probably be similar to that in the Eau Claire lumber case, in which the roads adopted the rates ordered by the commission just long enough to prove their impracticability and then cancelled them.

The Union Pacific has notified the roads which are now "boycotting" it that from Feb. 1 the Union Pacific will refuse to accept any business from connections east of the Missouri and Fort Worth except at Missouri River gateways and Fort Worth. For instance, a passenger via the Rock Island to Union Pacific territory must be delivered to the Union Pacific at the Missouri. This will tend to force the traffic over the Alton and Chicago & Northwestern, the two allies of the Union Pacific.

The directors of the Chicago Board of Trade have sent to President Harrison a resolution protesting against any action that will prevent citizens from availing themselves of the facilities offered by the Canadian railroads for transporting the products of this country through the Dominion of Canada and re-entering the United States free of duties and under proper restrictions.

Chairman Caldwell, of the Western Passenger Association, has received a communication from the Jobbers' Association of Minneapolis, opposing the adoption of the proposed 5,000-mile interchangeable mileage ticket. Petitions for its adoption from commercial travelers' organizations have been pouring in on the railroads for more than a year. The jobbers claim that expressions on this subject from "associations whose members employ and pay large sums of money to commercial travelers for railroad fares should have more weight than the wishes of commercial travelers whose tickets cost them nothing," and the argument is not without force.

Eastbound shipments of all freight except live stock during the week ending Jan. 21 aggregated 66,407 tons, against 79,736 for the preceding week, a decrease of 13,329 tons, and against 105,486 for the corresponding period last year, a decrease of 39,079 tons. Of flour there were 5,388 tons; grain and mill stuffs, 29,040 tons: provisions, lard, etc., 9,947 tons; dressed beef, 12,599 tons; flaxseed, 2,337 tons; hides, 2,329 tons; lumber, 2,816 tons; miscellaneous, 1,911 tons.

Coal Traffic.

The anthracite coal trade is enjoying a period of prosperity almost unprecedented. There is a great demand for coal from all parts of the country, North, South, East and West. The surplus stocks of coal in all quarters have been entirely absorbed, and the quantity of coal on hand at the various distributing centres is running very low. Consumers are clamorous for the speedy delivery of coal which they have ordered recently. The retail prices for anthracite nearly everywhere have been advanced, but the coal mining interests generally have wisely been satisfied with maintaining the full circular figures for their product without taking any undue advantage of the public. The transportation of coal via rail routes has been greatly hampered by the severely cold weather, and the shipments from tidewater have been almost suspended for several weeks past. The Reading road has been working train crews day and night for the past week in hurrying forward coal to points where it has been needed most, and also in transferring coal from points where it had been stored for tidewater shipment to other interior points where a shortage of supply was threatened.—*Philadelphia Public Ledger.*

The continued cold weather of last week was the reverse of favorable. The situation on the lines traversing extreme Northern Illinois, Wisconsin, Minnesota and the Dakotas was aggravated by the scarcity of coal. The scarcity here and inability of the railroads traversing the soft coal fields to supply more than a small part of the demands for transportation from the mines, coupled with an unusual demand for domestic and manufacturing purposes, also increased the perplexities. Chicago dealers bitterly complain that the coal carrying roads entering here from Indiana and Ohio were not only short of cars, but converted a good many train loads of coal ordered from the mines for Northwestern roads and retail dealers in the same direction; as a result many orders were unfilled.—*Chicago Cor. New York Evening Post.*